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SYMPOSIUM

on

FORESTRY AND THE PUBLIC WELFARE

Papers read before
The American Philosophical Society
Autumn General Meeting
November 17, 1944

THE AMERICAN PHILOSOPHICAL SOCIETY
INDEPENDENCE SQUARE
PHILADELPHIA 6

1945

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FORESTS IN RELATION TO SOIL AND WATER

RAPHAEL ZON

Director (ret.), Lake States Forest Experiment Station, University Farm, St. Paul, Minn.

(Read November 17, 1944, in the Symposium on Forestry and the Public Welfare, by Hardy L. Shirley)

THE entire philosophy of the role of the forest is based on the ability of the forest to prolong the water cycle from its inception as falling precipitation to its final disposal as runoff into streams and oceans. The longer the water is retained on the land, the greater is its usefulness in nurturing crops and trees, in maintaining a regular supply of water in streams, and in preventing the soil from washing. Simple as this relationship is, yet so many are the factors which play related parts in this influence, so great is the difficulty of observing them with precision, and so wide the range of economic interests affected, that considerable divergence of opinion still exists on the subject.

Whether the forest actually increases the amount of precipitation is, after eighty years of observations, still a moot question. Though parallel observations carried on in the interior of the forest, on the edge of the forest, and in the open show that the amount of rainfall, as registered by rain gages, is greater inside the forest than on the edge, and on the edge than at some distance from the forest—sometimes by as much as 25 per cent—they do not furnish convincing proof that more rain actually falls over the forest. All that these records indicate is that the rain gages inside the forest, being protected from the wind, may register more water than the rain gages in the open, where they are exposed to the wind. The most that can be said is that the forest may have some effect upon the frequency of precipitation.

The chief influence of a forest upon the moisture conditions of a locality lies in the manner in which it disposes of the precipitation it does receive. By breaking the violence of rain, retarding the melting snow, increasing the absorptive capacity of the soil, preventing erosion, and checking surface runoff, forests increase underground seepage in general. In this way precipitation, which without the forest cover is rapidly disposed of by surface runoff, is retained in the soil and gradually utilized for the growth of trees and crops and for maintaining a steady flow of water in streams.

This retentive power of the forest is brought about in several ways. The forest cover affects the temperature, the relative humidity, the wind velocity, and through these influences diminishes the loss of water through evaporation from the soil.

Ten years of meteorological observations conducted at the Forest Experiment Station in the Upper Peninsula of Michigan, near Marquette, showed that a northern hardwood forest lowers by several degrees the temperature of both the air and the soil inside the forest. The records further show that the relative humidity of the air is greater within the forest than outside by 3 to 10 per cent. In some cases the difference may be as much as 12 per cent. The wind movement in a broad-leaved forest of maple, birch, and beech, especially in summer when the trees are in full leaf, is often one-third of that in the open. While strong winds may be blowing outside, deep in the interior of a dense old forest there may be almost complete calm. All these factors affect the loss of moisture from the soil through evaporation. The loss of moisture during the growing season from the forest soil through evaporation may be only one-third to one-half of that in the open. Furthermore, the crowns of the trees may intercept as much as 15 to 30 per cent of the total precipitation. This water is evaporated back into the air to come down later somewhere else in the form of precipitation. The transpiration of water by the leaves, while it may decrease the total amount of water available for streamflow, enriches with moisture the surrounding air and thus prolongs the water cycle on the land. During the growing season especially, the temperature of the trunks, branches, and twigs is always lower than that of the surrounding area. This causes the formation of dew on the branches.

The difference between the temperature of the air in the forests and that in the open causes

air currents between the forest and the fields. These movements facilitate the formation of dew and fogs over fields adjoining forests.

The influence of forests on local climate is nowhere better illustrated than in the shelterbelt plantings of the prairie-plains region. Through literally hundreds of varied observations, it has been established that shelterbelts, placed at right angles to prevailing winds, afford a protection on the leeward side to twenty times the height of the trees—that is, with a belt 50 feet high, to a horizontal distance of 1,000 feet. The wind movement does not abruptly return to its initial velocity at this distance, but some measurable reduction has been recorded equal to fifty to sixty times the height of the trees, or 2,500 to 3,000 feet with a 50-foot-high belt. It is clear that some slight effect can be carried from one shelterbelt to another provided the spacing between them does not exceed about forty times their height. Furthermore, measurements have shown that considerable protection is afforded on the windward side, to a distance of three to five times the height of the belt. It is, therefore, entirely conceivable that if a large area were protected with shelterbelts at intervals of about two-fifths of a mile, there would be a considerable reduction of the wind movement over the area as a whole.

The retardation of the wind starts a whole chain of favorable climatic influences, such as reduction of evaporation, lowering of temperature, increasing relative humidity of the air, and accumulation of moisture by retaining snow on the fields—all of which result in increase of yield of crops grown under the protective influence of shelterbelts.

This influence of shelterbelts naturally varies with locality, dry and wet years, type of crop, and especially the width, length, density, and height of the shelterbelts, and the intervals at which they are planted.

Aside from their influences on crops, tree belts reduce soil blowing. The ability of wind to move and pick up soil particles varies at least as the second or possibly the third power of the velocity. Consequently, even as little as a 10-per cent reduction may mean the difference between considerable soil blowing and very little. A 50-per cent reduction in its velocity would practically keep the wind from moving soil particles.

In some localities of western Oklahoma, cottonseed sown on light sandy soils without the protection of shelterbelts is often blown out of the ground, necessitating a second and sometimes a third seeding and delaying the maturing of the cotton in the fall.

In winter, by reducing wind velocity 50 per cent and consequently reducing heat losses by radiation and infiltration, shelterbelts may reduce fuel consumption in farmhouses as much as 30 per cent. Such results were obtained with test houses, some of which were protected by shelterbelts and others exposed to the wind, the indoor temperatures being maintained at approximately 70° F.

Animals, too, suffer much less in cold weather if protected from wind, and some stock feeders consider a good windbreak almost as valuable as a shed.

Windbreaks play an important role in preventing snow from drifting, causing it to lie and melt evenly and thus water agricultural fields. In areas where windbreaks are not used, a considerable portion of the snow blows into road ditches or swales, where it is of no benefit to crops. By properly designing and locating windbreaks, highway departments find it possible to control snow accumulation and prevent drifts from forming on roads and thus reduce the cost of snow removal.

Forest soils have great water-holding capacity. The humus in the forest soils holds water equal to twice its weight, whereas sand and clay soils hold only one-fourth to one-half their weights of water respectively. What, however, is even more important is that the leaf litter in the forests keeps open the channels in the soil through which the water percolates into the ground. This storage capacity of the soil under forests depends a great deal, of course, on the character and depth of the soil. A shallow soil underlain near its surface with impermeable rock does not provide for much water storage, but if the soil is deep the ground forms a vast natural underground reservoir. As a well known hydraulic engineer, H. J. Morgan, remarked, "Dams are good, but if we could raise the underground water table of the Tennessee Valley only six inches, that would mean twenty-six million acre-feet of water—four times as much as the Norris Reservoir will hold—Nature would do the storing." The best aid to nature in storing this water is well protected forests on the watershed.

There is a great deal of conclusive evidence of the role of forests in water conservation based on long-time observations, chiefly, it is true, on comparatively small watersheds. A record of more than one hundred storms for a period of over two years on the Appalachian watershed showed

that the flow of water during peaks in floods from the deforested areas ranges from ten to twenty times greater than that from forested areas. Small streams which are usually continuous from forested areas dry up between rains on unforested lands. A record of a recent storm at the La-Crosse, Wisconsin, Station further illustrates this point. On August 20–21, 1939, a six-inch rain fell continuously within a period of twenty-four hours. Under the forest, this entire rainfall was stored in the soil, while more than two inches ran off from the fields under corn and grain.

It is not always easy to find for comparison large contiguous areas similar in every respect except the forest cover. Of particular interest, therefore, are weather observations made during 1933 and 1936 over an area of seven thousand acres in the Copper Basin of eastern Tennessee, which once was heavily forested but now has been completely denuded by smelter fumes. This denuded forest area is surrounded by a hardwood forest similar to that which originally occupied the basin. The records show that during both winter and summer average daily temperatures were 3° or 4° F. lower in the forest than on the denuded area and did not generally rise as high. Average wind velocity was seven to ten times as great on the denuded area in winter, and thirty-four to forty times as great in summer; and evaporation was twice as great in winter and seven times as great in summer. In the winter of 1936 precipitation was 17.5 per cent greater in the forest than on the denuded area, and in the winter of 1935 it was 25 per cent greater. In both summers it was more than 28 per cent greater. The climatic differences, except in precipitation, can be attributed definitely to forest denudation.

In the past, in discussing the calamitous effects of forest denudation, the Old World was drawn upon for examples—the denudation and overgrazing in the Alps and Pyrenees, with resulting disastrous torrents and their destruction of life and property; the deforestation in China and in the Near East and its terrible consequences. Fixation and reforestation of the shifting sand dunes in the Landes region of southern France and the extinction of the Alpine torrents by combined engineering works, sodding, and reforestation were cited as examples of the value of forests in remedying and preventing such disasters.

Today, unfortunately, we do not need to go to the Old World for such lessons. While the effects of the disappearance of the forests of this country have not yet reached the calamitous proportions that they have in some countries of the Old World, there is enough evidence to serve as a warning of what may come if the natural vegetative cover on the land is destroyed. Forest denudation, followed by gross misuse of agricultural land, has already resulted in the loss of millions of tons of soil material washed annually by the Mississippi into the Gulf of Mexico. The productiveness of some 57 million once-fertile acres has been essentially destroyed; that of another 225 million acres has been seriously impaired; and the fertility of 775,678,000 acres more is threatened. These striking facts have recently attracted the attention of the people.

In many places throughout the country the denudation of the mountain slopes by cutting, overgrazing, or fires has been followed by disastrous floods. That this damage is caused almost exclusively by the removal of the protective forest cover is shown by a comparison of two watersheds, one of which retains its protective cover and the other is burned. Two such canyons in southern California's chaparral-covered mountains, for instance, were visited during the last days of December 1933 by a general storm. Twelve inches of rain fell on both watersheds. On January 1, 1934, floodwaters swept out of the burned canyon and through a town, destroying two hundred homes and taking thirty-four lives. In the unburned canyon, just a few miles away, this general storm was easily handled by the existing channel, and there was neither flood nor water damage.

Forests may not increase the total precipitation but they certainly help to dispose of it more economically and more fruitfully than does land devoid of forests. In forests the water cycle is retarded, and in this way moisture conditions in the locality are improved.

In spite of these direct observations, the influence of forests on the flow of water in large streams and especially floods must not be exaggerated. In large rivers, the total flow of water depends to the largest extent upon the climate, precipitation, and evaporation. High and low stages of water in large rivers during a long period of years, as a general rule fluctuates with climatic cycles of wet and dry years. Floods which are produced by exceptional meteorological conditions cannot be prevented by forests, but without their mitigating influence the floods are more severe and destructive.

The hydrological role of the forest is different in level, hilly, and mountainous regions. In level

country where there is no surface runoff, forests, because of transpiration of water by the leaves, act in common with other vegetation as drainers of the soil. Hence their importance in draining marshy land and in improving hygienic conditions. A swamp covered with forest, after the trees are cut away, may become, especially in the northern climate, swampier than when it was covered with forest. Conversely, a swamp may be partially drained by reforestation, the trees acting as living pumps. In hilly and mountainous country, forests are conservers of water for streamflow. Even on the steepest slopes they create conditions with regard to surface runoff such as obtain in a level country. They increase underground storage of water to a larger extent than do any other vegetative cover or bare surfaces. The steeper the slope the less permeable the soil and the heavier the precipitation, the greater is this effect.

Knowledge of the intricate relation between climate and forests forms the scientific basis of forest practice. Such knowledge is essential in developing an effective system of protection against fire, determining the best methods of cutting in different types of forest, securing natural reproduction of the most desirable species, determining the possibilities of reforesting cut-over land, carrying on various cultural operations in young stands, such as thinnings and release cuttings, providing most effective protection of watersheds against rapid surface runoff and erosion, designing shelterbelts in the Great Plains for obtaining the greatest benefit to agriculture and improving living conditions—in fact, in all phases of forest practice.

The relation of forests to water is thus very intimate. A national or state policy which, though considering the direct value of forests as a source of timber, fails to take full account of all of their influence upon erosion, the flow of streams, and climate, may easily endanger the well-being of the whole people.

WOOD IN THE NATIONAL ECONOMY

CARLILE P. WINSLOW

Director, Forest Products Laboratory,[1] Forest Service, U. S. Department of Agriculture

(Read November 17, 1944, in the Symposium on Forestry and the Public Welfare)

It is indeed an honor to address the American Philosophical Society, which throughout our Nation's history has contributed so much serious thought to the problems and objectives of our way of life. The Society's selection of forestry and public welfare for the topic of today's symposium is, to me, a particularly significant demonstration of the awakening interest to the basic importance of forestry in a successful long-time solution of our economic problems.

Since colonial times, America's forests have contributed richly to our economic growth. During the years immediately preceding the present war, the gross market value of forest products in the United States was about three and one-half billion dollars annually. Nearly six million of our people were directly supported by workers normally employed in lumber, pulp and paper, and other forest industries. Residential and other construction employed hundreds of thousands of men, and our normal annual lumber requirement for construction and factory purposes has been estimated at about thirty billion board feet. Additional enormous quantities of timber are used in unsawed form and as wood burned for fuel.

During this modern war, as in all past wars, wood has proved indispensable. The normal peacetime production of wood products has been radically curtailed in spite of the staggering total of thirty-seven billion board feet of lumber consumption in 1943. Wood has quartered, transported, and gone into munitions for our troops throughout the world. We are all aware of the vast quantities of lumber going into the construction of military buildings. However, it is likely that few comprehend fully the list of wood items demanded by war's insatiable appetite—wood for hangars, scaffolding, boats, wharves, bridges, pontoons, railway ties, telephone poles, mine props, antitank barriers, shoring, shipping containers, and air-raid shelters; plywood for airplanes, blackout shutters, prefabricated housing, concrete forms, ship patterns, assault boats, ship interiors, truck bodies, and army lockers; fuel for gasogenes, for trucks and tractors; pulp and paper for surgical dressings, boxes, cartridge wrappers, building papers, pasteboards, military maps, laminated plastics, gas-mask filters, printing, and propaganda distribution; synthetic wood fibers, such as in rayon, artificial wool and cotton, for clothing, parachutes, and other textiles; wood cellulose for explosives; wood charcoal for gas masks and steel production; rosin for shrapnel and varnishes; turpentine for flame throwers, paint, and varnishes; cellulose acetate for photographic film, shatterproof glass, airplane dopes, lacquer, cement, and molded articles; wood flour for dynamite; wood bark for insulation, tannin, and dyestuffs; and sugar from wood for cattle feed and alcohol for explosives and rubber.

The amount of lumber used for containers for war material this year is more than sixteen billion board feet, or approximately one-half of the total volume of our lumber production.

Long suffering in past years from the encroachment of competitive materials, wood has become the wartime champion substitute of all time. National security demands that it always be available.

This unprecedented demand upon the forests for war purposes has caused the supplies available for civilian use to be cut to the bone, and a backlog of post-war civilian construction and repair needs has been piling up. In an effort to supply the essential demands, the normal inventory of lumber stocks has been steadily depleted and will require renewal. Added to these domestic requirements will be the demand for forest products that will be imposed by the huge reconstruction job in the war-torn countries.

During the years immediately ahead, there seems little likelihood that the national and international demands for forest products will be materially reduced, but that does not mean that our basic forest supply should be overcut so much as to jeopardize supplying our permanent and long-term needs. Following the temporary period

[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

of world readjustment to normalcy, wood as a material of industry and commerce will, of course, again be in competition with other materials, but in spite of this, will undoubtedly permanently be required in large quantities and will continue to contribute importantly to the national economy. In order to have our vast areas of forest land and timber stands so managed and developed as to contribute the maximum to the national economy much planning and many changes in current practices will be required. Prewar techniques and economies broadly utilized in useful commodities only about one-third of the total volume of timber harvested. Also vast stands of lower quality species which ought to be harvested were entirely neglected. If all such material could be put to economic use, the normal forest contributions to support of labor, employment of capital, and satisfaction of human needs could be enormously increased.

To guide the future to attain these benefits a number of significant factors must be recognized:

First and foremost is that about 80 per cent of all the labor employed through forests is from the harvesting, manufacture, conversion, transportation, and distribution of forest products, which activities maintain the great capital investments and communities dependent upon them. We must have large wood industries.

The second is that our utilization practices up to the present have been largely opportunistic, unbalanced, and poorly integrated.

The third is that past and present cutting methods are changing radically the diameter composition of the future stand. In the future, small-sized trees will predominate. A few decades will largely see the end of the big timber.

The fourth is that the available forest resources can be made to sustain an annual growth which at least in volume can exceed the predepression cut. It would seem to be entirely possible to provide a permanent and adequate supply of forest material for the maintenance of large forest industries, even though this supply must be different in size and quality from what has been available in the past, for the forest, unlike mineral resources, is potentially inexhaustible.

The fifth factor will be continuing competition in the wood products markets. Of course, as population grows and a more widely distributed prosperity is achieved, we may look forward to a more bountiful use of wood products, along with other commodities. But, on the other hand, as competing materials and products are improved and developed by research, wood products will lose their markets unless they too continue to be improved and developed by research.

Basically, it is final cost and serviceability to the ultimate user that will determine the success of industry in the face of all kinds of competition; and while serviceability, or quality, is largely subject to technical control and development, low cost hinges in a critical degree on *cheap and abundant raw materials and permanency and stability of operations.*

The sixth factor, which arises directly from the preceding one, is the trend toward greater public ownership of forest lands and greater public aid to private owners. Regardless of our individual views and of shifts in political currents, the impact of economic and social factors seems headed, through one process or another, in that direction. Such developments will have the advantages of easing the land situation, of reducing migration and adding stability to the utilization industries, and of insuring them a larger continuing wood supply.

The trend to shorter hours and higher wages for labor presents a seventh factor which we can hardly expect to diminish in the future. A man-day of work promises to become more expensive as time goes on; the question the wood industries must face is whether the labor cost per unit of product is going to increase also. The answer depends on two things—what the product is, and how the product is made. Some years ago, on the West Coast the lumber cost dollar lacked twenty-five cents of being big enough to go around, while at the same time the labor share of that dollar was just over fifty cents.

If the trend toward greater man-per hour production is a fundamental element in higher wages and higher standards of living, what does that mean for the future of logging and lumbering? Output per man in the lumber industry was not materially higher just before the depression than it was in 1899, whereas there was a gain of 24 per cent in the iron and steel industries, 58 per cent in stone, clay, and glass, 62 per cent in paper and printing, 120 per cent in non-ferrous metals, and over 1,000 per cent in motor vehicles; labor absorbs a larger proportion of the total production costs of lumber than it does for other basic materials that compete with lumber in the construction field. All this points to the need for greater mechanization in the wood-utilization industries, from tree to finished product; also, along with efforts to improve lumber production methods,

there is need for a conscious development of other products, in which improved mechanization and technical methods may count even more heavily and more effectively.

An eighth and closely allied factor is the greater economic value arising from the production of refined rather than simple or crude products. Number of employees and wages paid are a better guide to the importance of an industry than the mere bulk of material used; and while the normal lumber industry still ranks first among the wood-using industries in number of wage earners, that does not tell the whole story. For example, a given quantity of wood, if converted into paper, will provide employment for nearly three times as many wage earners as when converted into rough lumber; and if converted into rayon there will be nearly sixty times as much employment.

Other factors are that our large timber supplies are becoming increasingly distant from the great centers of consumption, and that future forest industries will give increasing attention to productive capacity of lands in relation to markets and transportation; ten trees on Pike's Peak may be worth less than one tree on the outskirts of Philadelphia on good soil.

Progressive evolution towards the foregoing objectives will require the adoption of proper controls, adequate fire protection, and taxation policies to stimulate long term stabilized and integrated forest industries. Basic to all, is research—diversified and adequate to the issues at stake. It must be directed at steadily improving the usefulness of normal forest products to which we have become accustomed, and of developing new products that will serve the consumer; it must give particular attention to use developments for the species available but heretofore not used and to the staggering quantity of waste material incident to logging and lumbering operations.

Fortunately, because of its variability and versatility in composition and properties, wood offers great opportunities for new developments through research. Today we are only on the scientific frontier of wood utilization.

There is an extensive body of technical information about forest products available, contributed by the forester, the engineer, the chemist, the technologist, the physicist, and the economist, upon which to base the programs of the future. We already know much about the properties of wood, its chemical makeup, and means whereby it can be improved. The manifold uses to which forest products can be put have been demonstrated by the present war.

Wood is an extremely adaptable and versatile material. It can be converted into many useful things. As in the past, however, the bulk of our future timber crop will undoubtedly go into use in the "raw" state, as lumber, for construction of all kinds.

The lumber industry as a whole is still operating under handicaps imposed by traditional methods of using its products. While engineering developments have greatly increased the ease of handling logs and brought about other refinements in the manufacture of lumber, there is still need for improvements through research and development in reducing the cost, enhancing the quality, and eliminating wastes in the manufacture of trees into boards.

Along with efforts to improve lumber production methods, there is need for a conscious development of improved mechanization and technical methods to improve its serviceability. For example, the use of modern timber connectors by the construction industry has helped to keep wood in use in large engineering structures. These connectors, which are iron, steel, or wood rings, plates, or dowels, are inserted between timbers and surround the bolts to bring greater areas of wood into bearing and consequently increase greatly the over-all strength of the entire timber structure. Thus wood radio towers, which were formerly restricted to a height of about one hundred feet because of the limitations of joint strength, can now be connector jointed and erected to a height of three hundred to four hundred feet. In the short period between 1933 and 1943 there were built more than 100,000 structures in which modern connectors were used, employing about five billion board feet of lumber valued at $165,000,000. Connector-built wood structures have been estimated to have saved 400,000 tons of critical steel in 1942.

Similar improvements in other types of fastenings could not fail to make wood serve more satisfactorily.

War has tremendously accelerated the process of making wood available in improved forms. Some of the new wood derivatives and modified-wood products are so altered as not to be recognized as wood; others look like wood but magnify wood's major virtues and add to its versatility. Notable among the improvements is the reduction of swelling and shrinking characteristics of normal wood that have limited its serviceability.

Moisture-resistant plywood is especially outstanding in new developments. Ordinary plywood, a product that dates back hundreds of years, made wood available in large sheets having properties more nearly uniform in all directions than normal wood; but only within recent years have weather-resistant glues been developed that make this material of major importance for outdoor uses, especially for housing, industrial and farm structures, and even for boats. Mass production of housing—conventional, prefabricated, and demountable—achieved significant headway only with the development of water-resistant phenolic-resin glues for structural plywood.

A recent development in timber structures, directly traceable to the development of improved glues and gluing techniques, is laminated wood. Such members are made in straight or curved form by bonding seasoned and properly surfaced boards with a water-resistant glue. A principal application is in the construction of roof arches, which have greater strength and efficiency and better appearance than were previously possible. Seagoing counterparts of the glued wood arch are the glued, laminated ship keels and frames now going into hundreds of small naval craft to take the place of solid white oak timbers of large cross section, which are increasingly difficult to obtain.

The properties of laminated members are essentially the same as those of solid wood, but of particular significance to the timber grower is the fact that laminated members permit the use of up to 60 per cent of low-grade and short length material in the interior laminations.

A familiar example of making wood serve more satisfactorily is the preservative treatment of railway ties and telephone poles. It is interesting to note that at a meeting of the American Philosophical Society on April 16, 1869, Dr. G. Emerson

> called the attention of the Society to the Robbins' process for preserving wood from mould and decay by the injection of the vapors of coal tar. Professor Cresson explained the difference between this and other processes for attaining the same end; especially one now in use in Philadelphia, in which the spontaneous inflammability of wood injected with high volatile hydrocarbons is guarded against by a subsequent injection of the surface with silicates.[2]

Today, three thousand treated railway ties are used for each mile of main-line track throughout the country, and have an average life of twenty-five to thirty years whereas untreated ties average only six years.

Recent estimates place the total quantity of wood used as fuel in country, town, and city at the huge figure of more than sixty-one million cords per year, representing the largest single form of consumption of tree volume in the United States, with the possible exception of lumbering.

As fuel, wood supplies a diversity of needs, such as house heating, the firing of sawmill boilers, cooking, some commercial baking, and the curing of tobacco and meat products. In some of its uses it may never be displaced, but in others large displacements have occurred and are still in progress. The development of more efficient wood-burning equipment for cooking, heating, and industrial service promises to give wood and wood waste a stronger economic hold as fuel where an adequate supply is available.

While the chemical products from wood bulk small in the over-all picture, it would be a mistake to dismiss them as of little consequence. Their importance as forest products is much greater than the volume of raw material consumed to produce them would appear to indicate.

Expanded chemical utilization offers a major opportunity for successful new industries and of gaining more complete utilization of the forest crop, because it does not require high quality wood and can use largely what is left from other operations, thereby reducing the enormous wastes that exist today. To make more economic use of wood by such utilization requires, of course, a degree of integration in the wood-using industries that, for practical purposes, is today almost nonexistent. Much research is also needed to evolve production processes and new products that can meet a competitive place in our markets. But enough is known about the potentialities of chemical utilization to warrant the belief that its products will have an increasingly important part in the forest industry of the Nation.

The most valuable chemical constituent of wood today is cellulose, from which are made, besides paper, such modern products as rayon, cellophane, films, lacquers, and explosives. Cellulose comprises about 50 per cent of all wood; the remainder includes hemicellulose, lignin, and extractives. Wood yields a variety of chemical products, such as methyl and ethyl alcohol, acetic acid, tannin extracts, naval stores, essential oils, charcoal, wood preservatives, furfural, and oxalic acid.

[2] *Proc. Amer. Philos. Soc.* **11**: 111, 1869.

From the chemist's standpoint, lignin, which constitutes about one-fourth of wood substance, remains the enigma of wood. However, its chemical mysteries are slowly being penetrated, and a variety of alcohols, oils, and an alkali-soluble resin have been recovered in recent laboratory experiments. Possibilities for its future extensive utilization are not only bright but of great importance. For example, great improvements have been made in a process of the low-cost production of ethyl alcohol from wood. The process is to be applied to the production of alcohol for munitions and synthetic rubber in a plant under construction in Oregon, to operate on saw-mill waste. Since one-fourth of the wood used remains as lignin, development of methods to utilize profitably this by-product is of great importance to the post-war success of such alcohol production.

Paper is by far the greatest single chemical product of wood, and indications are that it will continue to be. There has been a consistent and striking increase in paper consumption aggregating 300 per cent in the past generation, and the forces that generated this growth appear destined to remain fully operative for a long time to come as the population grows increasingly literate, disposable paper service goods gain in popularity, manufacturers broaden their use of packaged merchandise, and various other industrial uses new and old are stimulated. The Forest Service some years ago estimated our probable future pulpwood requirements at twenty-five million cords as compared with a normal pre-war consumption of twelve to fifteen million cords.

The anticipated increase, in terms of employment, represents some seventy thousand jobs in the comparatively well-paid pulp industry. Against this, however, must be weighed the facts that, in pre-war years, more than one-half of our wood for paper was imported as pulpwood, pulp, or paper; that an important segment of the industry is located in areas that no longer sustain it with locally grown pulpwood; and that it still leans preponderantly on a relatively few species. However, extensive capital investment in new mills can be looked for, on the West Coast including Alaska and no doubt also in the South, where technological developments have already created a thriving paper industry utilizing Southern yellow pine. In the established paper producing areas, however, pulp mills will be compelled to utilize an increasing diversity of tree species hitherto rejected or overlooked, and to develop processes for higher pulp yields from the wood. Fortunately, research has already shown striking future possibilities in these fields.

Any review of the utilization prospects of our forests would be incomplete without at least a mention of what is being done abroad. We know, for example, that Germany has exploited her forests and those of her neighbor nations to feed her war machine. She has used wood for clothing, for cattle feed, to furnish motive power, and for many other purposes. While in our own national economy, rich as it is in wool, cotton, textiles, agricultural products, and petroleum resources, these phases of wood utilization may seem at present of relatively small significance, we cannot afford to ignore the potentialities of any promising development either at home or abroad in terms of our own future forest industries.

In conclusion, let me reemphasize the following:

Research must blaze the trail for better construction, fabrication, and unit construction; better treating, coating, and gluing processes; better conversion and harvesting methods and facilities; keener selection and grading; the improvement of pulping process and machine operations in paper manufacture; the development of plastics and other new and special chemical products; and more fundamental knowledge of the composition, properties, and minute characteristics of wood substance.

We must continue to use wood on a large scale. Just as our future supplies of wood depend upon intelligent revival of our forests through the principles of sustained yield management, the very core of the forest conservation movement lies in maintaining and expanding industries using wood to manufacture products to satisfy human needs and wants.

We must have a more successful integration of the forest products industries. The sawmill, the veneer mill, the fabricating works, the pulping plant, and the chemical factory should complement one another as far as possible in every major forest area in order to realize maximum values from timber of the species, size, quality, and cost that will be available.

We must have stabilized rather than migratory industry, which leaves in its wake receding land values, declining timber production, falling employment and earning power, and shrinking tax revenues in the exploited areas.

By meeting modern demands efficiently, forest industry and forest ownership can look forward to a continued place of major service in the Nation's economic life.

WORLD-WIDE NEEDS OF WOODS AS A LAND CONSERVATION CROP

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I

Wood has played a vital part in mankind's doings from the simple rugged life of self-contained stone-age villages of long ago to our complex and industrialized society of today. Mankind has grown up with wood; and as an industrial raw material, it offers amazing prospects for satisfying manifold needs of a new day.

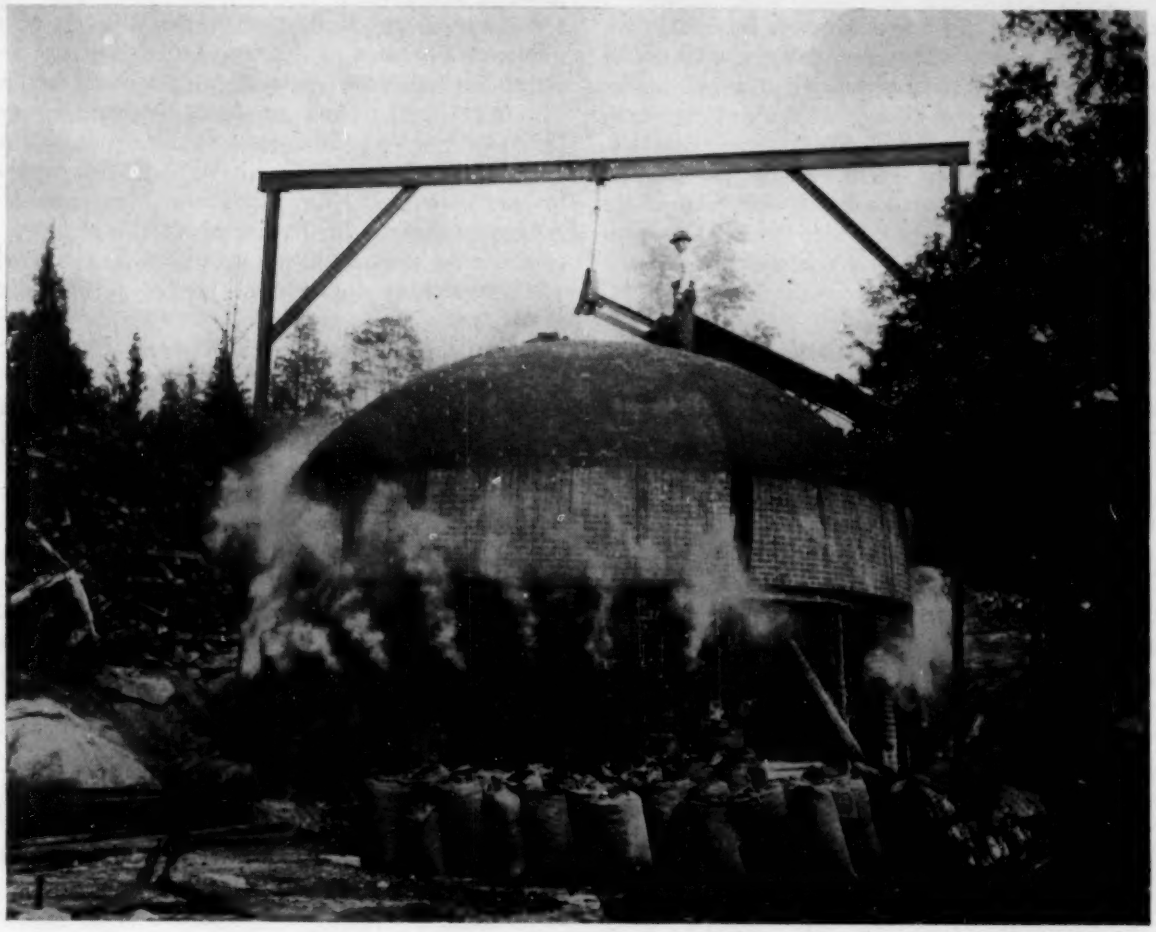
For convenience of study, students of civilization have divided the long and halting progress of mankind into ages of materials as stages of development. Learning how to make fire, early in the Old Stone Age, was a great advance—and it was wood that fed that fire. In the New Stone Age man learned to grow his food—to become a farmer. Advancement was very, very slow out of the mysteries of the Age of Ice. Discovery of metals increased the tempo of advancement; tools and implements made man more and more efficient. There followed the Ages of Bronze and Iron, and now our Age of Steel. It may be said that we are about to enter the Age of Wood; that new uses of cellulose fiber and its chemical compounds, raw materials of great versatility, are giving rise to a new age in mankind's long march out of an obscure past into a portentous and challenging future.

Wood is the product of photosynthesis and is the principal crop of woods and forests. It has peculiar properties that have made it next to food, man's oldest and most useful raw material. It burned to cook his food, on the camp fire or in the cave; and it burned to keep him warm. Wood was light, strong, easy to work for weapons of defense and of the chase, for tools, utensils, and furniture, and easy to handle to build his shelters. It floated in water for rafts and, later, boats. It served as a medium for carving to give vent to artistic urges, and for whittling. And nowadays, with advance in technology, wood is used for a multitude of purposes. It gives us clothes, artificial silks, lacquers, ethyl alcohol, cattle feed, plastics, dyestuffs, and gums, besides its time honored uses. It is impregnated and compressed to compete with metals for many purposes. Wood fiber, also, gives rise to many other products of high and new usefulness, creating ever new needs for wood. As a material from the first to the present, wood has made it possible for man to increase his efficiency in making good and useful things.

Uses of wood have increased in kind and amount with progress in the use of metals. Instead of displacing wood, metals have enlarged needs for this most versatile of raw materials. To be sure, the forest and its wood had their value to primitive man before he learned to make fire. But thereafter wood became more and more indispensable. The stone ax and other stone implements enabled early man in his enlarging development to make greater uses of wood. So did copper and bronze implements and tools. Discovery of iron and tempering it for steel widened man's needs for wood. The steel ax and saw gave much greater power in the preparation of wood for old and new uses. And in the past century the application of powered machinery in the harvesting, manufacture, and processing of wood and its transportation has still further enlarged the number and amount of its uses. Within the century mechanical and chemical conversion of wood fiber into pulp for making paper has ushered in an era of communication and spread of knowledge and news round the world that is fantastic. In only the past two decades research in applying chemistry and technology to wood and wood substances has opened up a vast array of ways for the making of useful things that are exciting in contemplation.

World-wide consumption of wood today can only be estimated because of lack of sufficient data.[1] On the basis of available information, it is estimated that the annual consumption is about 52.5 billion cubic feet, of which 28 billion are used for fuel, 15.75 as lumber for structural purposes,

[1]Now, however, the United Nations Interim Commission on Food and Agriculture is at work assembling just such information and is proposing a permanent organization to bring together these facts.



U. S. Forest Service photo.

FIG. 1. Although the making of charcoal has been practiced for several thousand years, only in recent times has wood distillation been developed to yield a number of chemical products besides charcoal. These include wood alcohol, acetate, creosote, and wood tar products.

3.5 for paper, 0.175 for rayon and staple fibers, 1.05 for railway ties, 1.05 for mine props, and 2.975 for other purposes.[2] Lumber makes up about 30 per cent and fuel 53 per cent of this vast amount of wood material. Fuel is the principal use of wood, despite the use of coal, oil, and gas, and will hold a high place for a long time to come.

Wood also stands second only to coal in world-wide production. Normal annual coal production is about 1.3 billion tons, while that of wood is 1.2 billion. Tonnage of wood production is ninefold that of steel, 12.5 times that of wheat, 10 times that of corn, 150 times that of cotton and 600 times that of wool. Wood supplies enormous needs of mankind the world around.

Of the world's annual wood harvest more than 90 per cent is used locally, but the other 10 per cent attains third place in value and first place in volume among all commodities of international trade. Products of the forest pay the largest freight bills of railroad and shipping lines.

The world's most important source of industrial energy at present is coal and oil, which are consumed in their use. Metals are not destroyed in use but are dissipated in wear and rusting and are recovered as scrap only in diminishing amounts. Metals lost in sinkings in deep waters of the oceans are beyond recovery. The world's supply of nonrenewable resources is being used up. They will become more and more scarce and costly to

[2]Anonymous. Unpublished manuscript, United Nations Interim Commission on Food and Agriculture, Washington, 1944.

mine. The end of known stores is in sight, with rapid expansion of drains of modern civilization and especially of modern war. But wood, unlike coal and metals, is a renewable crop of the land. With understanding and foresighted practice, wood may be grown in increasing volumes to supply raw materials that with modern technology may meet the needs of wider and wider and greater and greater uses for the welfare of mankind.

Wood material is a wonder of chemistry and physical structure. Wood substance is a hygroscopic gel with a specific gravity of 1.5± that is quite uniform in all wood materials. But cellular structure and chemical content of cell cavities give rise to a wide variety of materials of many properties that serve hundreds of uses even to paper and clothing fabrics. Modern technology has by special treatment of impregnation with resins and compression produced new materials from wood that compete with certain metals. Chemical industries are opening up amazing possibilities in deriving from wood as raw material new chemicals based on fermentation of carbohydrates, even to the making of alcohol for rubber manufacture.

II

It has been given me to study the use of land in many parts of the world and especially in those regions where mankind has dwelt the longest in organized societies. I find that where mankind has lived the longest, lands are in worst condition; forests are destroyed and peoples are reduced to lowest states of general well-being. In some measure it is possible to associate the condition of a people with the abundance and condition of its forests. Many factors determine the fate of a people, but certain it is that when food and raw materials for clothing, shelter, transport, and communication diminish in abundance and accessibility, the general welfare declines. Scarcity of wood is thus a measure of the need for this raw material of many and variable uses.

Such an inference may be drawn from the land-use history and present condition of lands of the Near East. Here in the Holy Land of Western Civilization, one may read a tragic record written far and wide and deep-cut into the land. It appears that irrigated agriculture arose in the alluvial valley plains of the River Nile and of Mesopotamia. Between these regions of growing populations lay the forested mountain ranges, rising to 10,000 feet in Mount Hermon, along the eastern shore of the Mediterranean, in what is now Lebanon, Palestine, and Trans-Jordan. From inscriptions found by archaeologists in excavations of ruins of the past and translated by them, we are led to believe that the famous forest region of the Cedars of Lebanon was a source of timber supply to peoples of the Nile Valley and Mesopotamia. An inscription on the Temple of Karnac of Egypt, of about the year 2,840 B.C. according to Breasted (3), announces the arrival in Egypt of forty ships laden with timber from the forests of Lebanon. The ancient city of Byblos was an outpost of Egypt at this time, from which timber may have been regularly shipped to the land of the Pharaohs. Recently discovered correspondence on clay tablets of King Zimrilim of Mari on the Euphrates, dating from about 2,000 B.C., tells of his sending boats to Carchemesh, northeast of the Lebanons, to be loaded with cedar and other timber (5). In the great cylinder inscriptions dug up at Tello, the site of ancient Lagash in Babylonia, Gudea, ruler of Lagash, tells how he built himself a road in the mountains of cedar wood (identified as the Lebanon Mountains), cut great trunks of cedar trees, and floated them down in rafts for beams, stair rails, and doors of the great temple he built (11).

Fragments of clay tablets found in ancient Assyria bear this record (8) from Tiglathpileser I, of about 1,100 B.C.:

> To Mount Lebanon I went. Logs of cedar for the temple of Anu and Adad, the great gods, my lords, I cut and brought away.

An inscription of Assur-nasir-pal, who reigned from 883 to 859 B.C., found at Tell Bolaivat (the ancient Imgur-Bel) records (9):

> I marched into Mount Lebanon and cut down beams of cedar, cypress, and juniper, with the beams of cedar I roofed this temple, door-leaves of cedar I fashioned, and with a sheathing (bands) of copper I bound them, and I hung them in its gates.

A clay tablet from the reign of Assurbanipal (668–626 B.C.) as part of the "royal annals" records:

> The temple of Sin in Harran . . . gave way. . . . Great cedars which had grown exceedingly tall in Mount Lebanon . . . which the kings of the seacoast, my vassals, had felled . . . and had laboriously dragged out of their mountains, a wearisome region, to Harran,—with these I roofed Ehulhul, the abode of gladness. . . . At the beginning of my reign I completed this splendid temple.

Isaiah indicates (1) that both Sennacherib of Assyria and Nebuchadnezzar II of Babylon had the Cedars of Lebanon felled. An inscription of the latter has been found in a valley on the northeast side of the Lebanons in which the king describes how he split the mountain and broke the rocks to make a way for sliding out the long trunks.

The Bible contains numerous other references to the Cedars of Lebanon and gives a vivid picture of the extent of the cutting of timber for ancient works of construction.

King Solomon is recorded to have made a bargain with Hiram, King of Tyre, to exchange wheat and olive oil out of his Kingdom, including Palestine, for timber of fir and aromatic Cedars of Lebanon for the construction of the Temple at Jerusalem. According to the record (2) Solomon furnished 80,000 lumberjacks as hewers of wood for the woods operation in the forested mountains and 70,000 burden bearers to skid out the timbers. The forests that covered the lofty shoulders of the Lebanon Mountains must have been extensive to keep such a force of 150,000 workers busy.

Although the cedar forests of Lebanon had been cut since the dawn of history for local needs and commerce, a considerable area remained and was protected during the Roman period, as is indicated by boundary stones standing now in barren mountains. For years, the meaning of rock-cut inscriptions with the name of the Emperor Hadrian abbreviated and often the letters DFS (4), found in various places in the Lebanon Mountains, was a mystery. Several were removed to museums. The mystery was solved on the discovery of a large cornerstone on which DFS was written out in full, reading as follows:

IMP–HAD, the abbreviation for *IMPERATOR HADRIAN*, or Emperor Hadrian, and AU combined in a single character.

G–DEFINITIO G, with the AU on the first line, makes AUG, signifying Augustus. *DEFINITIO* means limits, or boundary.

SILVARUM means "of forests."

The accepted translation of the stone is:

EMPEROR HADRIAN AUGUSTUS
FOREST BOUNDARY.

These numerous and widely distributed inscriptions[3] were obviously boundary markers of a forest area protected by imperial Roman edict.

[3]See maps showing locations in Pauly-Wissowa, XIII, cols. 5–6, and col. 7; and in Corpus Inscriptionum Latinarum, III (inset).

During the Roman and Byzantine domination, up to the Arab Invasion in A.D. 630, timbers from these forests were used throughout the Roman world in great temples and other works of construction, and for Roman ships that plied the Mediterranean. The invasion of nomads out of Arabia began the destruction of conservation works of all kinds or allowed them to fall into disrepair from neglect. Little or no effort was made to preserve tree growth, and forests of cedar dwindled from year to year. The ubiquitous goats grazed back seedlings, preventing reproduction. The soil was denuded of vegetation and thus exposed to heavy erosion by winter rains after long dry summers. Furthermore, sharp hoofs of sheep and goats in herds clamoring up and down the terraces dislodged stones. Soil behind the terraces was rapidly eroded away unless rock walls of terraces were kept in repair, and this was done in only a small fraction of the former terraced area.

The last slaughter of remaining mighty trees of Lebanon took place during the Turkish domination from 1516 to 1918. A tax was imposed for every individually-owned tree (10, 14). In this way a premium was set on annihilation of trees and forests. On national lands, or common lands, trees were exploited to the limit to supply fuel for locomotives during the World War, when Turkey was cut off from supplies of coal by the blockade. Since the invasion of Arab nomads, thirteen centuries ago, the forests of Lebanon have been exploited and neglected, until the slopes have been rendered barren, gray, and rocky, making impossible the restoration of forests equal to the original stands.

Today, there are but four groves left of the ancient and famous forests of the Cedars of Lebanon, which once extended over an estimated area of about 2,000 square miles of the historic area of old Phoenicia. Of the three groves visited, I found the Barouk and Massa groves to be less accessible and to consist of isolated patches of trees on steep rocky slopes. The most important remnant is the Tripoli grove of cedars, on two small knolls at an altitude of 6,000 feet. On the basis of the finds in the grove, the recent history of this historic grove is reconstructed as follows: Until about three hundred years ago veteran trees were unprotected, and at that time they had been reduced to no more than forty-four "wolf trees" among rocky barrens still marked off by Hadrian's boundary stones. A Maronite chapel was built about this time within the grove of scattered

trees for shepherds who ran their flocks over the upper slopes of the mountains. Thereupon the grove became sacred. Trees were protected from the vandalism of man, and the wall about the grove kept out the goats and protected seedlings. During the intervening years, a stand of about four hundred straight-stemmed trees has grown up about the forty-four veteran "wolf" trees within the walled enclosure. All cutting of trees is now prohibited, but a windthrow gave me an opportunity to make a ring count. The count on the stump, 40.5 inches in diameter, was 272 annual rings. The tree belonged to the younger age class of the stand. Now seedlings are growing up around the margins of the grove in the protection of the stone wall.

This sacred grove of cedars yields valuable information to one reading the story of land use and the destruction of a forest that furnished timber to populous empires of the Nile and Mesopotamia. The restocking of this grove, under protection since the construction of the little church, refutes arguments that this famous forest has disappeared because of an adverse change of climate. On the contrary, the evidence is that its disappearance is due to clear cutting followed by cultivation and grazing of these ancient forest lands. The supply of wood products from the famous forest area was reduced to practically nothing in the face of greater needs. And withal the population of the region declined in this period of forest destruction.

In China, another story of forest destruction is told in eroded country around temple forests (7). As population pressure increased, farmers pushed cultivation out of flat and rich alluvial plains up slopes, higher and higher, to grow food for themselves. In agricultural explorations in 1924 to 1926 I found thousands of cubic feet of felled timber rotting beside grain fields on mountain slopes in the Province of Shansi. The forest had been cleared primarily to get at the soil to grow food for mountaineers. In a recent survey of Northwest China we found that former forest areas had been cleared away except when protected by the sanctity of temples.

The disappearance of forest crops in the face of need of wood products in these long inhabited areas may be accounted for in more than one way. Where timber was within skidding distance it was cut and moved down to the valley towns or to some water shipping point to be sent to some populous center. But in more remote areas timber was cut primarily to get at the soil to grow food, and only a small part of the timber cut was used.

In these ways mankind, except in a very few instances, for lack of understanding or for lack of social control in long-range management of forest areas, has permitted the urgency of immediate needs to waste and to destroy the crop that yields valuable wood material for fuel and construction and for decorative and many other purposes, or to reduce it for succeeding generations whose needs for it increase with industrialization.

In forested regions, mankind under primitive conditions uses the forest for a small part of its wood, as in the case of shifting cultivation, or Milpas agriculture. In forested hills and mountains primitive peoples both in the Old World—in India and eastern Africa—and in the New World—in Central and South America—carry out the following practices. A patch of timber is cut, with stone axes, and allowed to dry, then burned. In the ashes a crop of grain is dibbled, to make use of plant nutrients released in the ashes. Weeds may be pulled up from about crop plants, but usually little hoeing is done. After about three years the fertility is so far lost in growing the crop, in erosion and in leaching, and weeds have so taken the patch that the shifting farmer abandons the weedy field and fells another patch of timber for a new field. From time to time this shifting is repeated until he returns to former patches after about twenty to thirty years. In the meantime the forest has restored fertility to the soil, making the land ready for another cycle of "shifting cultivation."

When the cycle is speeded up in a return clearing before the forest has had time to restore soil fertility through decay of forest litter, the productive capacity of the land rapidly deteriorates. Where there is room enough, villages move to new sites to carry on new cycles of shifting cultivation. But when a country becomes crowded with people practicing these primitive measures, the damaging effects of soil wastage and erosion begin to show up and the inhabitants become restive under diminishing crops for enlarging populations.

In regions where population pressure on the land has become high and where transportation is costly, need for wood is met as far as possible with substitutes. In my travels in Northwest China, a region often afflicted by famine conditions, I have stayed in houses built of stone, or dug out of loess cliffs. The door frame, door, and window lattice covered with thin paper to let in some light were made of wood because no other

material would do. The only wood within the house was chopsticks. Wood for fuel often was lacking, in which case stalks and roots of crop plants and animal manures were used as fuel. The soil was thus robbed of organic matter and fertilizer, with consequent reduction in the intake of rain and increase in rates of runoff, which created more and more erosion, to waste and damage soils for growing food crops. Lack of wood with these resultant conditions generally lowers well-being of the people.

The imperious need for the wood crop and for conditions that favor full production of forests and farm woodlots stands out in these instances of forest exploitation prior to the development of industries.

Industrialization has not spread through human society uniformly over the earth. There exist today various stages of evolution of social structures toward highly complex industrialization, such as may have evolved in a modern nation through a century and more. The consumption of wood and its products becomes roughly a measure of the degree of industrialization—yet not altogether.

Some regions are more advantageously placed than others for economical access to wood crops. Parts of forested lands of the United States, in northern Idaho and eastern Washington, for example were classified as suited to farming. To my personal knowledge, 1919–1922, settlers were homesteading the logged-off land, to carve farms out of a former dense forest. After logging, the land was stocked with many large trees that would not pay logging costs, by reason of defect or of inferior quality of wood. Besides, a heavy cover of slash lay upon the ground. Here wood material was in excess of need for a proposed use of the land. Fire was used to destroy as much of the wood as possible, to remove the encumbrance of woody material.

In the urge to own tracts of land as a stake in security for the future, the forest was ruthlessly destroyed and woody material wasted, but most of this land still stands in stumps and unfarmed. This hit-or-miss type of settlement of forest land has been wasteful of land and of forest products, demand for which now considerably exceeds forest growth. Much forest land has been misused in this way.

In a rapid survey of the land area of the world, we recognize several broad types of land and natural crops of vegetation. According to James (6), the land surface can be classified as follows:

	Per cent
Tropical forests	13
Boreal forests	9
Mid-latitude mixed forests	7
Medium scrub forests	1
Drylands	17
Grasslands	19
Mountainous area	18
Polar regions	16
Total	100

About 30 per cent of the land area was originally covered with forest growth, much of it unmerchantable or inaccessible. Drylands and grasslands make up 36 per cent, including about 5 per cent classed as true desert. Farm land for growing of food has been carved out of grasslands and mid-temperate forests, and to a small extent out of drylands that could be irrigated and for certain specialty crops out of tropical jungles.

Forests have had to give way before use of land for growing food. But lack of foresight, with some notable exceptions, has brought on destruction of the forest as a long-term crop in the face of increasing need for its wood products and of its favorable influence in control of erosion and silting of streams and retardation of storm runoff.

III

Wood glut and wood famine may exist at the same time in different parts of the world or of a continent. Ratio of haulage costs to sale price controls the range of movement of wood products. Cost of man and animal portage is high, and quickly makes up the sale price of the product; then stumpage value is nil and forests have no commercial value— and they generally are treated so. Driving timber down rivers permits moving timber long distances at comparatively low cost. Cutting of forests thus is pushed far inland along streams, as is true today in many parts of the world. Powered transport by rail permits of longer hauls, but only for the most valuable products. Transport by ship allows for the longest hauls, but is still restricted to the most valuable and to a small part of wood products of the forest crop.

Out of the present situation of wood glut and wood famine arises the question: What are the essential needs of the world in wood? Or, what is the per capita need of wood to secure to the individual the comforts, conveniences, and efficiency that may be sought as the right of a human being in a world of abundance? Such a goal can be

only theoretical and philosophical at the present state of topsy-turvy adjustments of mankind to the earth's resources. On the other hand, it is well to indulge in such speculation if we seek a long-range answer to this question of world-wide needs of wood.

Substitutions and economies enforced by costs of effort or exchange values of other useful things cause the per capita consumption of wood to vary widely. This variation ranges below and above what may be thought of as the minimum requirements for well-being of a people. New discoveries in use of wood as a raw material also affect the minimum requirements of people for wood. Under primitive conditions the per capita needs for wood were small, but in a modern industrialized society, where mechanical power is more and more in use, they are far greater and are growing each decade.

The increase in the use of wood pulp for paper in the last 100 years well illustrates this tendency. In the United States wood pulp began to be substituted for rag pulp in the making of paper in 1840. Per capita consumption of wood pulp increased from nothing in 1839 to 305 pounds in 1940. Shall we say that 305 pounds of wood pulp per person per year is enough or too much or too little for a highly industrialized nation? Favorable location of great areas of forests in northeastern United States and in adjacent Canada has made it possible to get a great abundance of wood pulp at comparatively low cost, and this product of the forest has been used extravagantly and wastefully. It is doubtful that the present rate of consumption can be kept up. Industrial use of wood pulp is growing more rapidly than potential production of pulp. We face enforced economies in this useful wood material.

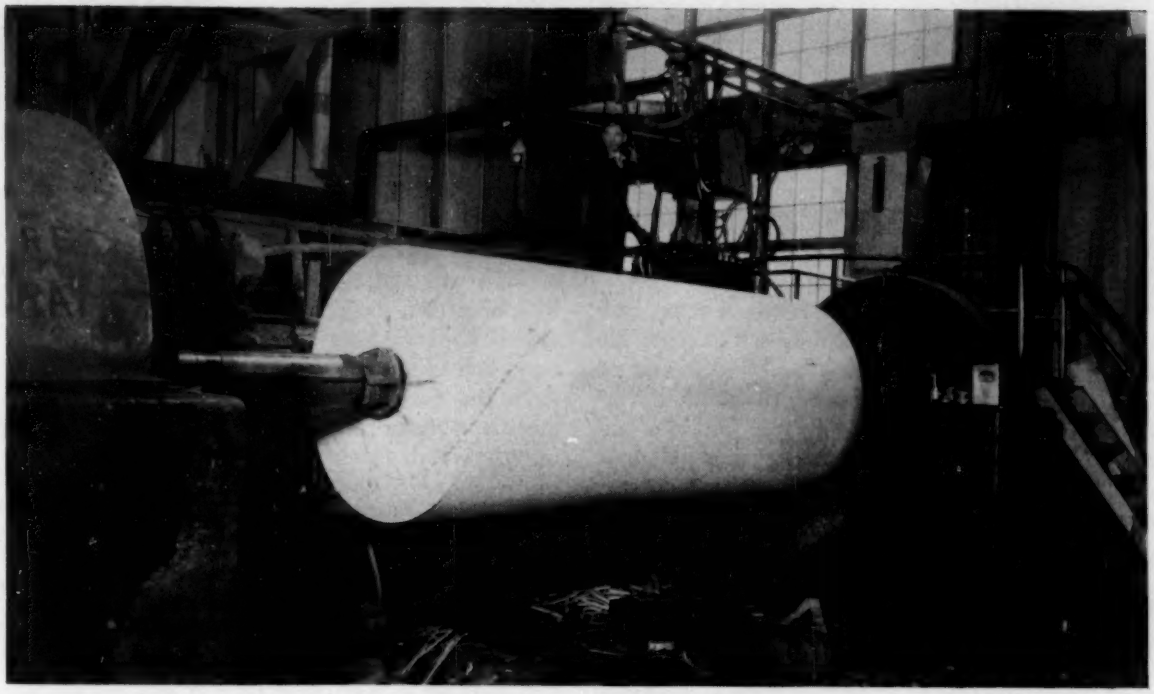
The per capita use of wood of all kinds is thus related to the stage of industrialization of a people, to its purchasing power of useful products, to the location and relative abundance and economic accessibility of timber. Finland and Sweden, for example, are heavily forested countries of high levels of welfare and industrialization. In 1928–1929 the annual per capita consumption of wood was 245.8 cubic feet in Finland and 162.8 cubic feet in Sweden. Both countries export timber in large quantities. France, while growing a considerable amount of timber, must import certain quantities to supply its economic needs. The annual per capita consumption for the same period in France was 26.8 cubic feet. Great Britain, a highly industrialized country, grows only about 5 per cent of its requirements for timber and wood products and must import the remainder. Annual per capita consumption in Great Britain in 1928–1929 was 23.2 cubic feet, practically all construction timber and lumber. The annual per capita consumption of the United States for the same period was about 90 cubic feet, including fuel (13).

Turning from this range in per capita consumption where the country's production of timber is in excess of needs and where it is far below the needs of modern industrialized society, let us compare per capita consumption in countries long inhabited but with low state of industrialization. For China annual per capita consumption is estimated from available sources[4] at not more than 2.0 cubic feet. Timber forests in China, except in Manchuria, have been pushed far back to rough regions difficult and costly of access. Driving timber down streams is the cheapest and now only feasible means of timber transport for considerable distances in interior China. Local supplies are generally depleted. Per capita consumption represents a great deficiency for present requirements and particularly for the needs of China in the reconstruction period toward which the country now is working.

In the Near East, home of large and prosperous populations of ancient empires, per capita consumption is believed to be the lowest for any important area of the world. Timber resources, never very great, have been practically destroyed until dung is a substitute for wood fuel; and in northern Syria, a region containing a "hundred dead cities" in whose houses much timber was used, nowadays mud beehive houses are built without a splinter of wood. Per capita consumption must be below one cubic foot in the Holy Land, another region where population has declined far below that of its prosperous past.

To one seeking a guide to the minimum requirements of wood in a modern society, the per capita consumption of Great Britain has special meaning. It is reasonable to assume that in a country having to import 95 per cent of wood products, chiefly construction material, wood is not wasted. And because of accessibility to sea lanes and of short inland hauls, the cost of delivery of imported wood products is not so great as in large continental areas. Per capita consumption of wood by Great Britain may be accepted as the minimum requirements of wood products, except for fuel, in a modern industrialized society of the better stand-

[4]Lin, D. Y. Unpublished report on forest situation in China, Chungking, 1944.



U. S. Forest Service photo.

FIG. 2. Powered machinery has made it possible to shave great logs into strips of thin veneer. The material in this form and with efficient glues has given rise to many new uses of woods that are daily spreading in our modern civilization.

ards of living. This consumption does not include fuel because England is fortunately well supplied with coal that is generally used for this purpose. Since fuel wood cannot be profitably shipped far, it will always be primarily a local product. Growing wood lots well distributed throughout a country should be favored in the sound development of a nation. The figure for Great Britain, 23.2 cubic feet per person per annum, represents the minimum of construction timber and lumber that may reasonably be required for the well-being of human society under normal conditions of peace. It will not do for the post-war reconstruction period. This amount must be increased, for fuel and other purposes, to about 60 cubic feet. It must be kept in mind that this figure of 60 cubic feet may well increase with new discoveries and technological treatment of wood to supply wood pulp and for many new purposes including substitutes for certain metals.

On this basis the requirements of wood products, including wood pulp, for the world population of two billion souls, would work out to an annual crop of 120 billion cubic feet. Such an enormous figure gives us some idea of the needs of mankind in a new world of reasonable well-being. The present consumption of about 52.5 billion cubic feet is less than half this computed requirement of the world's population. A large portion of humanity has not yet achieved reasonable possibilities in command of this useful and versatile material.

The forest area required to grow a crop of wood of these proportions can only be guessed at, on the basis of the incomplete data now available. Here too, however, a rough estimate may be made on the basis of known rates of wood growth under forest management. For in looking forward to a world of abundance and well-being for humanity, the forest must be managed as a crop with sustained production of most usable and worth while products, a need too long delayed.

Rates of growth vary with soil, temperature, rainfall, season, and certain other factors. The area required to grow this enormous crop of wood will vary with the extent and location of the production forests by climatic zones and soil regions. With improved inventories of land and climatic resources of the world, refinements in computations can be made from time to time.

On the basis of the available information, it is estimated that the average annual growth rate per acre of normally stocked timber stands in cold temperate zones approximates 15 cubic feet; in warm temperate zones, 30 cubic feet; in the subtropical zones, 50; and in the tropics, 75. Under present treatment of forests, an average annual growth of 25 cubic feet per acre is estimated for the principal commercial forest areas. Improved management would double this figure.

Here no distinction is made between temperate softwoods and tropical hardwoods, with their wide differences in use. Moreover, account should be taken of the portion of annual growth that contributes to the commercial consumption of wood and wood products. Generally this portion is not more than one-third. The remainder of the crop is used locally as fuel and otherwise, or left as waste in the woods.

The area required to grow the vast annual crop of wood will be about 4.8 billion acres, or 2.4 acres per capita on the average for the world population of 2 billion souls. The present cultivated area of the world is estimated from available information at 3.7 billion acres, or an average of 1.85 acres per capita. In another paper[5] I have concluded that increase in agricultural production is to be had from improved use of lands already under cultivation rather than by clearing or reclaiming new land, important as that is. The area possible of cultivation in economic farming enterprises is 4 billion acres, or 2 acres per capita of the present world population. Land in managed forests would need to be greater by 20 to 30 per cent than land in cultivated crops.

But this would not be enough. Timber must be grown on areas economically accessible to its places of consumption. Equable distribution of timber-producing forests with regard to climatic and soil limitations is as much a part of supplying wood requirements as allocating sufficient timber-growing area to forests. Long hauls of bulky and heavy wood products will limit per capita consumption of this useful material in the face of needs for a better condition of well-being. The growing of wood requirements locally is an important factor in supplying world-wide needs of wood.

IV

The sustained production of wood crops to meet world-wide needs involves a choice in the use of land over extensive areas of the United States as well as in other parts of the world. Recent amazing discoveries in new uses of wood material promise the substitution of the wood crop of forests for many products of cultivated fields that now are sought as raw materials for industries. The most notable is, of course, rayon products for cotton, which is a clean tilled crop that on slopes introduces serious hazards in erosion wastage of soil resources. Plastics may be made from wood as well as from certain cultivated crops such as soybeans. This substitution may well extend to other cultivated crops.

In the prospect of the call of industries for more and more raw material from farm crops the importance of forest crops increases. This is because of hazards of soil erosion on slopes that are cleared and cultivated. For in six thousand years of agriculture the tiller of soil has met with his most difficult problem in establishing an enduring agriculture on sloping land. The natural vegetative cover of a soil has through long periods of time established an interdependence with soil that has set a very slow rate of normal geologic erosion. Normally, soil is eroded no faster than it is formed and differentiated into topsoil and subsoil. Soil formation takes place under natural covers of vegetation on slopes of river valleys that have been excavated by geologic norms of water erosion in the process of time. But when such slopes are cleared of the natural cover of vegetation and are cultivated, and especially to clean-tilled crops, a new type of erosion—accelerated or induced erosion—takes place, that goes on faster than soil is formed. This means land wastage and destruction unless conservation measures are put to use to offset the hazard of slope.

The steeper the slope, the greater is the hazard to sustained use of land under cultivation and the more complex and costly are necessary measures to safeguard the soil resource.

Flat or nearly flat lands such as alluvial river bottoms and river deltas are free of the hazards of water erosion under ordinary types of farming. Such types of land require no special measures to safeguard the resource under cultivation. But unfortunately such land in America, or for that matter in the world, is comparatively small in area. Results of classification of the land of continental United States in farms give an example of the problems of slope farming throughout the world. The United States contains one of the largest single blocks of gently sloping land

[5] Lowdermilk, W. C., Principles of sustained land use. Unpublished, 1944.

best suited to cultivation. Yet in this country the area of Class I land, that is, land requiring no special conservation measures under cultivation, is 71,808,000 acres, or 6.81 per cent, out of a total of 1,054,053,000 acres of land in farms. Of this total, an additional 418,762,000 acres of land are suitable for sustained cultivation when simple to complex conservation measures are applied. A total of 440,175,000 acres is unsuited to cultivation but best used for grass forage and forest crops, and some 23,329,000 acres fall into a miscellaneous nonproductive class. The area of land safe for cultivation without special conservation measures is 14.6 per cent of lands that are classed as suitable for cultivation.

This means that most of our farm production must come from sloping lands. Practically the total area of land suited to cultivation is now under cultivation. Maladjustments exist in the rougher regions. Extension of cultivation of land to grow raw materials in quantities for industries can only be had by pushing the cultivation line up steeper slopes, with an increasing hazard to the soil resource or with greater cost in application of conservation farming.

It becomes plain then that wherever forests are grown to supply raw materials for industry that are now being supplied or may be supplied from cultivated crops, we shall safeguard the soil resource in an effective way. For the forest, when scientifically managed, is the most perfect soil conservation crop and assures the best protection from soil wastage and the best retardation of storm runoff. The importance of making use of the forest crop to supply more and more of the raw materials called for by industries is outstanding in the over-all problem of full and safe uses of land. The urgency to work toward this end is already present and will increase. For there is danger that industrial demands on fibrous raw materials for papers and plastics will develop more rapidly than forests can be restocked on lands too steep for safe cultivation. This is a problem of highest importance before the United States and before the world in general as we enter the post-war era.

The rapid growth of uses of the remarkable raw material wood, stimulated by technological and chemical engineering, and the insatiable demand of industry for wood material are a threat to the safe and sustained use not only of forest land but of cultivated land as well. Foresight calls for a comprehensive and thorough examination of this major problem in conservation and for the spread of measures that have been worked out to assure maximum sustained production of wood from all types of forest land, for the well-being of our people of the United States and the people of the rest of the world as well. The objective would be an increase in production of wood material, in time, to at least 60 cubic feet per capita per annum, and such distribution of this production as would make it economically possible for peoples of the earth to earn their requirements in a wide range of products made of woods.

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AMERICA'S ROLE IN MEETING WORLD TIMBER NEEDS

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We have been hearing a good deal, recently, about greatly increased demands for wood after the war, and the prospect that the world will look to North America, particularly to the United States, to supply a large part of it. Some predict that wood will be needed in huge quantities for the repair and reconstruction of war-damaged homes and other structures in Europe and Asia, for the industrial development and better housing that are expected to come in many countries, and for many new uses of wood products that have been only partially explored. Some, relying on the fabulous capacity to produce that America has shown during the past five years, believe that we can and should supply timber to the world at large in almost unlimited volume. Others, recalling all that they have heard about depletion of our forests, do not agree. The purpose of this discussion is to look into the background of the situation, and with this as a basis to see what may reasonably be expected to happen.

Before the economic depression of the 1930's the world consumed annually about forty-five billion cubic feet of wood in all forms. Almost half of it, or about twenty billion cubic feet, was used for fuel in the raw state or modified as charcoal. Some 5 per cent, about two billion cubic feet, was used for pulp to make paper, paper board, rayon, and many other cellulose products. Roughly 15 per cent, seven billion cubic feet, went into a wide variety of products, such as mine timbers, posts, poles, piling, house logs, staves, matches, excelsior, handles, veneer, and plywood, and hewn ties and timbers. Only 35 per cent, sixteen billion cubic feet, was sawed into lumber, including boards, planks, sawn timbers and ties, and box shooks.

For all of these timber products except firewood and charcoal the United States has for many years been the largest consuming country. Before 1930 we used approximately two-fifths of the world's sawn wood, half of the pulpwood (or paper made from it), and perhaps 45 per cent of all wood other than fuelwood.

Although world trade in forest products has not been as important in volume or value as trade in many other commodities, considering the volume of world consumption, an important international trade in timber products has grown up. Even though forests are widely distributed they are not evenly distributed over the world. This is especially true of the conifer forests. Forest products export has been an important element in the economy of such countries as Finland, Sweden, Norway, the Soviet Union, the countries of East, Central, and Southeastern Europe, and Canada. Others, such as the United Kingdom, Netherlands, Belgium, South Africa, and the countries of North Africa, have had to import the bulk of their supplies. Many countries that are potentially large exporters have not developed their timber resources, as for example South America, and many that are potentially large importers have not attained a standard of living which requires any considerable consumption of food products, as for example China.

As to the United States, it is both an exporter and an importer of timber products. Taking all wood, including that imported in the form of pulp, we have imported more than we have exported for a good many years—at any rate, since 1914. Our principal export of forest products has been in the form of softwood lumber. Our exports have made up from 10 to 20 per cent of total world trade in softwood lumber and represent less than 5 per cent of total world consumption.

Looking at the future, a careful distinction must be drawn between world needs for timber and its products during the immediate post-war years and needs for the longer period. The war has disrupted normal trade relations, changed the pattern of demand for forest products, closed off some sources of supply, and developed some new ones. It may be five years or more after the close of the war before a settled pattern of production, consumption, and trade in forest products will begin to appear.

Thinking of "needs" as meaning effective de-

mand for forest products, it is impossible now to estimate accurately how much wood individual countries or the world will need during the reconstruction period. Early estimates have placed Europe's post-war lumber import requirements as high as 6 to 10 billion board feet per year, but it may be that conditions will neither require nor permit imports in this volume. It seems safe to assume, however, that very large quantities of lumber will be needed immediately, along with cement, metals, brick, and stone, for rebuilding towns and cities, farm buildings, railroads, bridges, and harbor works in countries that have been bombed and shelled. The countries that have escaped direct war damage will also have immediate needs greater than usual, for during the years when wood has been going to war civilian consumption has been postponed.

In the United States, home building and repair and other construction, excepting that connected with the war, has been far below normal for most of the last fifteen years. As soon as the war ends there will be an urge to resume construction on a large scale. Millions of houses and farm buildings are needed, and we hope that there will be a purchasing power to support this need. Moreover, lumber stocks at the mills and in dealers' hands are now at an extreme low. They will have to be replenished to the extent of perhaps 10 billion board feet for the distribution system to function normally. There is every reason to expect, therefore, that we shall require at least as much wood during the next ten years as we used in the decade following World War I. This would mean that our timber output will have to remain at close to the wartime level, just to supply our own needs.

It has not been easy to meet these needs since 1940, even though our average net imports of lumber and logs from Canada more than doubled and our pulpwood imports increased by 25 per cent, while our net export of lumber and logs to other countries was more than cut in half. The difficulty was due in part to wartime shortages of labor and equipment. The scarcity of suitable timber within easy reach of many of the existing sawmills was also a contributing factor to reductions in production.

Although we still have a large supply of standing timber, it is not so distributed as to be equally available for utilization. A few mills have sufficient stumpage to last them many years; many are nearing the end of their timber, with little prospect of getting more. Moreover, the average quality of the remaining timber tends to become poorer as the better quality old growth timber is cut out. In the absence of systematic forest management of most of the forests in which cutting is done, the United States' ability to provide for its own timber needs and to supply a surplus to the rest of the world is steadily diminishing. It appears doubtful, therefore, whether we can contribute very much wood to other countries in the immediate post-war years unless we allocate a part of our own normal requirements in these commodities or premeditatively accelerate the depletion of our forests. If the latter step is taken, depletion will of necessity occur where present mill facilities exist and where the problem is already acute. It is doubtful whether there is time enough to meet immediate post-war needs to expand facilities in the less accessible remaining virgin forests. If, for international comity and for good will, we must extend ourselves during these immediate post-war years, it would probably be best to use the first method suggested, namely, allocation from stocks that we normally would use for our own requirements.

World timber needs for the longer period after the war are even harder to forecast than are the immediate needs. For countries whose economies have reached a certain maturity, estimating is not too difficult. But what will India, China, or Latin America need fifty years from now? We do not know to what extent these countries will become industrialized and whether their standards of living will rise simultaneously.

Neither can we tell, at the present time, how well the rest of the world will be able to supply its timber needs twenty, forty, or sixty years hence. Europe, in the past, has normally been self-sufficient, but the war has had its effect on European forest resources. Though information is fragmentary and conflicting, there is no doubt that much timber has been destroyed in the zones of active fighting. Probably even more has been cut in and near the combat areas to supply the needs of the fighting forces. Much timber has been cut behind the lines, for both military and civilian use. Cutting has tended to be concentrated on the more accessible forests where a large volume could be produced with a minimum of transportation and labor. Where such concentrated cutting took more than the periodic increment within a given area, the productive growing stock was reduced. This, coupled with the cutting of many thrifty, fast-growing young

stands and the failure to cut in the more remote forests, has resulted in at least a temporary diminution of annual increment.

Cutting in excess of the growth has been rather general in most European countries during the war, and in some of them for a number of years before. Official German estimates, for example, indicate an aggregate excess cut from 1934 to 1944 of some ten billion cubic feet. Some of this was obtained from improvement cuttings and from surplus timber reserves accumulated in earlier years, but probably two-thirds of it represents a reduction in the growing stock—almost 10 per cent of the total timber stand. Cutting in some other European countries is reported to have been even heavier under German occupation, and some of these were already overcutting before the war.

In the more important timber-exporting countries, Sweden and Finland, cutting of firewood has been much heavier than normally, but the cut of saw timber has been far below the pre-war level. Their potential output for a few years after the war may be somewhat greater than before.

The situation in the Soviet Union is obscure. Much timber has certainly been cut and destroyed by both the Russians and the Germans in the western portion of the Soviet territory. However, Russia has such great timber resources that a large output can be maintained in the post-war period, provided manpower and equipment are available to cut the timber and get it out of the forests. Russia will need great quantities of timber for reconstruction of devastated areas. She may get some from Finland and Southeastern Europe, but in the main probably will supply her own needs. Whether she will have much of a surplus for other countries in the near future is problematical.

Even though certain foreign countries may have future timber needs in excess of their ability to supply them, this is no assurance that they will seek to import products from the United States. Certain possible barriers to foreign trade—mechanical, political, and economic—may have to be eliminated before we can export forest products freely. Shortages of shipping facilities to carry forest products in world trade may be a further limiting factor. Political barriers that take the form of tariff restrictions on forest products, the prohibition of imports, or created barter agreements, may limit or even exclude the United States in world timber markets. Economic barriers in the form of price or shipping costs may limit American timber products in foreign markets. Furthermore, foreign purchasing power in American markets may have to be selective, choosing certain import products in preference to others. I have touched on the question of barriers that have existed to foreign trade because that cannot be lightly brushed aside. These are matters that we all pray will be given full consideration in post-war agreements between nations.

Now let us turn to our domestic forest situation. We know that we have 630 million acres of forest land in various states of productivity. A quarter of this area is non-commercial forest land because of low productivity or extreme inaccessibility. Much of it is on high mountain slopes where its value is high for watershed protection, recreation, and game cover, but low for commercial utilization of wood products. Of the 461 million acres of commercial forest land, on which we must depend for forest products, 341 million acres are privately owned and 120 million are in the hands of the Federal or State governments. Private lands include possibly 90 per cent of the potential timber-growing capacity of the entire country, and furnish 90 to 95 per cent of the present cut of all forest products. The key to our forest situation, therefore, is to a large degree in the hands of the private owner of forest lands.

We need a forest cover on much of the non-commercial land in order to protect watersheds. We need thrifty forests on the commercial forest lands for the indirect benefits provided and for the products that can be harvested from them. But actually our basic forest wealth is declining. Even without the stimulus of wartime demands the drain on our commercial forest lands has been exceeding growth, and saw-timber drain has been in excess of saw-timber growth. Even this does not tell the whole story, for while the timber being harvested is economically accessible and of relative high quality, much of the new growth is of low quality, in less dense stands, and the remaining virgin forests become progressively less accessible.

Our forests can be maintained. Adequate protection from fire and other losses on the non-commercial areas, and proper management of commercial forest areas can provide the indirect benefits and the forest products needed for our economy. Forest growth of good quality in accessible stands can be increased to equal drain, and a permanent supply of products, permanent industries and communities, and permanent protection for watersheds can be assured. Intensive

forest management can readily double or triple our annual growth and be the basis for an expanding economy in forest products.

Here, then, is the problem. Should our primary efforts be devoted to supplying immediate postwar world needs for timber, whatever they may be, without regard to the effect of this policy on our own present and future forest resources, and our ability to contribute permanently to world timber needs? Or should our primary efforts be devoted to placing our forest lands in condition to produce abundantly for the long pull?

In a larger sense, the resource of any country is a world resource. Our ultimate forest wealth must be considered as part of the world's wealth. We must plan to put our own house in order as our contribution to world prosperity. By doing this we should be able to contribute more toward making the world a better place to live in, than we could by setting our sights solely on immediate profits or on trying to supply *in toto* all of our present needs. A healthy forest economy in the United States, I hold, will benefit other nations. Not only will it assure them a possible source of timber supply to meet future needs, but it will enable us to provide them with other commodities of even more urgent necessity than timber products. For example, if foreign nations want agricultural products, our forests can help us provide them. Forest cover will regulate streamflow and help to prevent erosion of farm land. It will help to provide a steady supply of water for irrigation. Forests will provide lumber to house farm labor, to build farm implements and equipment, and to package our farm products for export. If other countries want metals or machinery, our forests will aid in the production of these commodities by providing timbers for our mines, cross ties for our railroads, dunnage lumber for the rolling mills, patterns and flasks for the foundries, handles and other wooden parts incorporated in the products, and wooden or fiber containers for shipment. It is difficult to think of anything we produce where forests do not play a direct or indirect part in making that production more effective and more efficient.

If there is merit to this thesis, and if the solution of our domestic forest problem is the proper approach to the whole problem of world needs, there is much to be done. And it must be done soon, for it is easier to keep and to improve existing forests than it is to reproduce new ones from scratch.

By maintaining our forests we do not mean setting them aside as unproductive preserves. Conservation of forests means wise use and wise management. We need to continue harvesting forest crops to provide the products our economy requires. Commercial forest lands in private ownership must yield annual revenues if permanent management of these lands is to continue and prosper.

The general public unfortunately is not fully apprised of the forestry situation but would probably recognize that there are problems we should start solving. Among those who have given this matter fuller consideration there is general agreement as to the steps that must be taken, but there are violent differences over some of the details of carrying out any definitive program. Conservation groups would agree perhaps on some of these essential steps.

Lands in public ownership must be managed to produce optimum benefits in the form of forest products and the less tangible values derived from a good forest cover. A forest cover must be maintained on some forest lands where commercial forest practice will not be attractive to private enterprise. To provide stable ownership and continuous protection and management of lands in this category, increased public ownership may be the safest procedure.

The public must share with private ownership the responsibility of keeping privately owned lands in productive condition. The public must exercise its leadership in conducting research and in pointing the way to proper forest management. It must accept part of the financial responsibility when the public interest justifies it, through assistance in fire protection and insect and disease control, adjustments in the tax base or taxing methods, and in providing credit at reasonable rates. Good forestry must be financially attractive to private owners if we are to expect them to do their part voluntarily, and where commercial forest lands in private ownership are heedlessly or needlessly mistreated, I am certain that we will recognize there is a public responsibility to exercise some form of control.

The experience of the older European countries which faced a forest problem similar to ours many years ago demonstrates that regulation of forest practices is not only necessary but is ultimately welcomed by the majority of the forest land owners who have a personal and public interest in stable and permanent forest industries.

A program with the objective of solving our

domestic forest problem rather than of giving primary consideration to foreign timber needs might appear, at first glance, to be utterly selfish. Granting the advantages of international cooperation—and I would never deny them—the success of any international cooperation depends on the ability of the individual cooperators to contribute to the general well-being. The whole may be greater than the sum of the parts, but the magnitude of the whole depends on the adequacy of each individual part. International cooperation to improve education, health, government, economic welfare, or any other phase of life depends, in the last analysis, on the ability of each country to improve progressively its own conditions within the limits of its capacity. The richer and more advanced countries will, of course, for their own safety render whatever help and assistance they can, if a peaceful world is to be established. And, what we say about education, health, and so forth, applies equally in meeting the problem of supplying the world with its timber needs.

Unless our forest wealth is built up properly and developed and managed, the most that we can offer our neighbors is temporary assistance and false hope, because in the process of helping we may destroy the very source of that wealth. Optimistically, we can predict that if we put our forest property in order we can continuously increase our exports. But for the time being we may have to limit exports more or less to the pre-war scale, until our forest property is built up. If we pursue for the next fifty years what may, on the surface, appear a patently selfish policy of putting our forests into real productive shape, we will be in a much better position to render greater and more permanent assistance to other nations in fifty-year periods indefinite in number.

FOREST CONSERVATION: A TASK IN ENGINEERING AND IN PUBLIC AND PRIVATE COOPERATION

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(*Read November 17, 1944, in the Symposium on Forestry and the Public Welfare*)

ORDINARILY in recent years public discussion of forest affairs and forest problems has taken the form either of an unlimited adventure in statistics; or a diverting lyric of the beauty of trees and the annoyance of seeing them cut down; or a more or less amiable "sparring bout" over public forest policies which have been a prolific source of debate for half a century. I want to engage in no one of these today but rather to outline in simple terms some of the forestry prospects as I see them, against a background of changes and progress in the forest industries during the past quarter century.

You have asked me to discuss with you these forest matters from the standpoint of forest industry. I have accepted your invitation. But I should say to you that on these complex matters there is no such thing as a concerted industry judgment or a collective industry point of view. The views which I express may be regarded not as an official statement of an industry-wide judgment but rather, I think, as a growing opinion, or possibly as a prevailing trend. Or you may regard them as personal opinion of my own. In any event, among forest owners and forest industries there are great differences of opinion. From anything I may say that is worth saying you can find dissent. All generalizations I am told are wrong, including, no doubt, this one.

The United States Government, of course, is the largest owner of forest lands—about a fourth in area and about a third in volume of timber stand. Private forest ownership ranges from the millions of farm woodlands which together constitute about 40 per cent of the total, to the thousands of moderate sized commercial forest lands which account for another 40 per cent; and to the hundreds of comparatively large industrial ownerships largely incorporated. Similarly, the forest industries range from the tens of thousands of turpentine "farmers," one-truck log contractors and one-gallus circular sawmills, to the hundreds of moderate sized logging and milling enterprises mostly family-owned, and to the scores of gigantic enterprises in lumber manufacture, pulp and paper, and other wood conversion in the West, South, and North. Forest products industry is a substantial factor in nearly forty states. In twenty states it is a minor, in seventeen a major, and in nine a predominant source of industrial employment and community maintenance.

Forest enterprise has practically all the ramifications and variations which are characteristic of ordinary agriculture from the big range, the power farm, and the farm cooperative to the "forty acres and a mule," the walking plow, the thinning soil, and the stingy local merchant. The total area of our forest land is greater than the total area of our farm land. In the Northwest timber conversion is now and probably in some form will continue to be the number one industry; and in the South trees and wood conversion will eventually provide more sources of employment and a more dependable livelihood than did cotton in its heyday. So you can measure for yourselves the hazard of generalization on a subject of this kind in a thirty-minute speech.

The backbone of what I have to say today is in two other speeches which I have had occasion to make in the past two years to vastly different audiences. One was a year ago at the annual Convention of the National Lumber Manufacturers Association to a representative group of forest owners and manufacturers. The other was two years ago at Duke University to a group of young forestry students. To the former I was speaking of the great transitions which have occurred in the forest industries during the twenty-five years that I had been associated with their National activities. To the latter I was speaking of the "Future of our Forests" which largely will depend on the constructive imagination, the talents, and the tenacity of just such men as are being trained and graduated by outstanding institutions as the Duke Forest School. Since at least I cannot be regarded as plagiarizing I shall

quote briefly from these two addresses. Whatever your conclusion on the merits of what I may have to say, you will know that at least I have been consistent. That I conceive to be important in open public discussions, especially in groups such as the American Philosophical Society whose intellectual contacts have such wide ramifications both in this country and elsewhere.

To the lumber manufacturers and forest owners last year in part I said this:

During this period (of twenty-five years) there have been a number of rather important changes in our industry, of which occasionally we may remind ourselves, lest we forget, or sometimes become disheartened because the progress is so slow:

Twenty-five years ago lumber was a migratory industry. There were then only three Tree Farms. Today the lumber industry generally has "settled down." There are hundreds of Tree Farms and thousands more are in the making.

Far fewer lumber companies are trying to get out of the lumber manufacturing business and far more are trying to find ways of staying in it.

More forest owners are interesting themselves in growing trees as well as cutting trees; and are studying the possibilities of continuous timber production, more complete utilization, permanent operation, and dependable employment.

As to permanent forest production, forest owners twenty-five years ago were generally indifferent. The lumber business then consisted of cutting and manufacturing trees, not of growing them, and then moving on where there were more trees. Foresters were regarded as pleasant gentlemen with quaint and rather impractical ideas—somewhat like economists. But there has been a great transition. Foresters in an increasing number have risen to dominant places in this industry. To the forest-owning enterprise which seeks to manage its lands with the same skill with which it manages its logs, the forester is indispensable. Within less than another quarter century I expect to see the forest industries of this country *dominated* by the ideas of foresters—and fundamentally those ideas will be these same "quaint and rather impractical" ideas, enriched by experience, and become the key to the continued livelihood of a great industry.

Twenty-five years ago this industry collectively was almost equally indifferent to research. The scientist was a "foreigner," although many individual lumbermen noted and envied the great achievements of other industries based on science and invention. There was reason for that indifference. That was still a period of timber surpluses—at least apparent surpluses. Practically all lumber production was from virgin timber, and more virgin timber was easy to buy. Timber values throughout its history up to that time had always carried the financial load of this industry.

There is still a lot of indifference. But some major industry groups are distinctly research-conscious and are willing to back their interest in research with funds. There are hundreds today who are beginning to recognize that an industry which eventually must grow its own timber at its own expense may hardly be expected to meet the competition of more efficient industries, if it does not learn how to utilize more than 40 per cent of its raw materials, and are beginning to see the future of their industry as much in the crystal of the test tube as in the sharpness of the saw. . . .

Structural timber is now recognized and respected as a frontline engineering material. Plywood has become one of the modern marvels among industrial products. Laminated lumber, making big pieces out of little pieces, has comparable prospects. Lumber has made itself the "backbone" of home-building in this country. The lumber industry faces after the war what probably will be the greatest nationwide demand for home-building in its history. It has no serious problem of reconversion.

"Lumber standards," standard grades and the certification and grade-marking of standard lumber have grown into nationwide recognition, respect and acceptance.

The lumber industry has developed a system of supply and demand statistics and current trade information not exceeded by any other large industry.

The lumber industry has learned to cooperate with other forest industries and to get their cooperation. It has learned also to cooperate with other natural resources industries with which it has found an increasing field of common interests and common problems.

Lumber is no longer regarded as "obsolete," or the lumber industry as a "sleeping giant."

Lumber is no longer an "unpopular" industry, and it is emerging from this war, on the whole, with a fine performance record, a cooperative relationship with the war agencies, and a heightened prestige. That did not happen in the last war.

The lumber industry is respected. More lumbermen over these years have learned to respect their own industry and have discovered that its future is not all in the past. Other industries respect it. The Government respects it. The public respects it. This has not always been so.

How, you may ask (and I am still talking to a group of forest owners and manufacturers), about the liabilities side of this balance sheet? We can enumerate them just as well. But you need little reminder of the weaknesses in our industry or its failures and indecisions because in the main you have to deal with them or with their consequences every day. They are your constant reminder that this industry still has more problems than it has answers.

Only one I will mention now. Many individual forest owners and many groups of operators have

come squarely to grips with the forest conservation problem, including the issue of public regulation of timber cutting practices on privately owned forest lands. But this industry as a whole has not done so. We have been more zealous, or at least more effective, in declaring sound principles than in putting them into practice. Repeafedly in recent years we have recognized and declared the wisdom of converting into *state* forestry codes to be administered under appropriate *state* laws, by competent *state* agencies, forest practices and methods based on tested experience in each region as furthering continuous forest production and sustained yield operation of forest lands. But as a national industry we are still holding this issue at arm's length. . . . Anyhow (and I am still quoting) over a period of years, you have had action rather than talk; you have put the Association on the map; no one any longer thinks that the future of the American lumber industry is in the past; and the lumber companies continue to run the lumber business.

Now as against that, let me repeat what I said a year before to the group of ambitious young forestry students:

Americans, in a country of comparative forest abundance, but living among towering skyscrapers, glistening airplanes, and shiny gadgets of steel and aluminum, often have merely taken for granted the day-to-day essential uses of wood. Notwithstanding a background of national history in which wood has been indispensable, a devastating world war has been necessary to focus national attention on the continuing extent of our dependence on forests. . . . We, whose grandfathers looked upon the virgin forests as a burden, often a menace, and at least an encumbrance to the land, understand why the profession of forestry in America is comparatively young. It had its roots in Continental European forestry which has nobly inspired, but also sometimes misled, American forestry. It has grown in importance, in significance, and in national recognition. At long last American forestry has come to have a science as well as a tradition of its own. And that science is fast emerging from the closet of the forest philosopher and getting into the woods with the cruiser, the surveyor, and the "man with the axe."

Two generations in this country have listened to prophecies of approaching timber exhaustion until many have believed it their patriotic duty to use material other than wood so that the forests may be saved. *They would save at the spigot rather than provide at the source.* . . . As a college student I was introduced to the study of American forests in the shadows of an imminent "timber famine." That shadow has been lengthening as the prospect of national scarcity of timber has become constantly more remote. Foresters, forest owners, and forest industries alike have come in recent years to see for themselves that their future is not all in the past.

I expect in the not too distant future (and I am still talking to these young foresters) to see a national timber growth in this country which will substantially exceed the present prevailing national timber use; a substantial reduction in our excessive losses of forests by fire, insects, and disease; and a gradual restoration and improvement of our so-called "forest capital"; and I expect to see this accomplished in the woods and not in Congress.

My faith in this prophecy is supported on the one hand by the constant flow of new uses for wood and cellulose, to supplement, rather than supplant, present uses; and on the other hand by the safe assumption that, given a reasonable chance, trees will grow, will reproduce themselves, and need only simple and inexpensive encouragement to provide continuous timber crops.

Nine years ago it was my privilege in behalf of the lumber and timber products industries to introduce to the National Recovery Administration, the famous so-called "Article X" of the Lumber Code. Under its provisions these industries, in cooperation with the United States Government, undertook certain forest practices desirable in each region. In introducing what later was approved by the President as "Schedule C—Forest Conservation Code," I used then ten words which I thought then, and think now, were of more than ordinary significance: "This is an industry undertaking. It will be so administered."

That undertaking in organized industry-wide cooperation was terminated in the final sorrows of the National Recovery Administration. But its wholesome effects have continued in an expanding interest in industrial forestry and the exploration of its practical possibilities in terms of continuous timber production, stable industry, and permanent forest-dependent communities. A part of its aftermath is the growing interest in American Tree Farms. . . .

In this country with its abundant forest resources, I think we do not need to follow the parsimonious pattern of European forestry; and the sooner we stop treating forestry as a perpetual "emergency," the more progress we will make in forest conservation. Forestry should be a promise; not a threat. People do not grow or invest in things they are afraid of or are uncertain about. They invest in things they have faith in. American forestry needs less agitation and more silviculture. . . .

It is, of course, entirely possible by law to require certain practices in timber cutting and in forest land management. But it is, I think, much preferable that these desirable objectives be achieved through the combined processes of education, economic inducement, and public and private cooperation. Progress in forest conservation accomplished in that way is more likely to be dependable and permanent. . . . On the other hand, no country has ever solved its forest land problems without some measure of public regulation. I do not think that this country will either. My

own view is that certain simple restrictions on timber cutting and certain simple requirements in forest land management are both necessary and desirable; that these should be based on the tested experience of forest landowners in each region; that they should be locally administered under state law; and that state forestry commissions competent to administer such state forest practice codes should be built up and maintained in each state.

Had the *Nina*, the *Pinta*, and the *Santa Maria* carried a scientific staff comparable to a modern exploratory expedition, Christopher Columbus could have reported to his royal sponsors the discovery of a dense forest extending from the Atlantic Coast west to the Great Plains. Had the explorers opened a trail comparable to that followed by Lewis and Clark they would have reported vast pine forests in the mountains, and heavy fir, spruce, and redwood forests on the Pacific.

Within the boundaries of what is now the United States were over 900,000,000 acres of forest, practically half of our present land area. Some 800,000,000 acres of the original forest have since been described as saw timber, the rest as in brush stands.

During the three hundred years from 1630 to 1930, by United States Forest Service estimates, a total of over 14,000 billion feet of forest products has been removed or lost from America's forests. Nearly 60 per cent, or a total of 8,500 billion feet, was destroyed. Over half of this, or 4,600 billion feet, was lost by forest disease, insects, windfall, and other natural causes; 1,700 billion feet, or one-fifth, went up in smoke; and one-fourth, or 2,100 million feet, was destroyed to clear the way for agriculture.

Of 6,000 billion feet, which went into products, scarcely more than a third, or 2,150 billion feet, went into lumber. The demands for fuel, which reached their peak in the sixties and seventies, and which are now of considerable proportions, used considerably more, or 2,700 billion feet. The remainder, nearly one-fifth or 1,100 billion feet, was used largely for railroad ties, posts, poles, piling, and pulp and paper. Timber use, timber destruction, and timber wastes in such colossal figures could have occurred only in a land of great forest resources.

Today there are about 1,750 billion feet of saw timber on about 450 million acres, or one-fourth the original volume on about one-half of the original forest land; and to this may be added the current growth on the somewhat less than 200 million acres of logged lands recorded as in at least a fair condition of forest growth.

This forest condition has been variously described as "neglected" or "unsatisfactory" or "dangerous." Obviously it has been "neglected" and in terms at least of forest protection and neglect dates back to colonial times when the forest itself was regarded and usually treated as a public enemy. Clearly also it is "unsatisfactory." I do not think it is accurate, however, to call it "dangerous" in any important sense.

The more important fact, I think, is that the forest condition is improving, slowly, gradually, unevenly to be sure, but generally and in every region. The war pressures have temporarily retarded and in some cases reversed the trend toward forest improvement. Just how much, I do not know. I do not think this is of any great lasting consequence, however, because most of it has been due to the constant drive for more war production of forest products with continuously dwindling manpower and inadequate equipment, and I am confident that the general trend toward forest improvement will be resumed and accelerated after the war and emergency reconstruction pressures are somewhat relieved.

The forest industries, of course, wish to have all these forest and forest industry matters handled so far as possible in terms of private ownership and private enterprise with the minimum of participation by agencies of Government. It is entirely natural, on the other hand, that Government agencies should be less enthusiastic about this idea of "minimum of participation." In fact, there are some—although I think not many—in the public conservation agencies who have no faith whatever in the efficacy of private forest ownership either now or at any time. I sometimes wonder what kind of a national economy they think we would have if private ownership of forest and farm lands were somehow to be supplanted by some form of public or governmental enterprise.

For twenty-five years I have been the executive officer of the National Lumber Manufacturers Association. That is a federation of regional associations of forest owners and manufacturers of lumber and timber products in nearly forty states. It represents over three thousand separate enterprises which in the aggregate provide the principal livelihood for two million people. It owns no trees and no mills. In these forest matters it can take and does take these five actions:

1. To conduct forest surveys and provide forest information.
2. To provide a convenient forum for the expression of industry thinking on forest matters.
3. To make forestry recommendations to timberland owners and industries.
4. To provide technical and advisory services to help interested groups of forest owners to put any of these recommendations into effect on their own lands or in their own enterprises.
5. Through research and technical services, to promote a wider, more efficient, and less wasteful use of timber and wood products by these industries and by the public.

The Association is, of course, a mechanism for voluntary cooperation. It has no facilities except information, technical services, and an industry spokesmanship which over the years has, I believe, gained a substantial industry-wide and public recognition.

Of the numerous actions of the Association I shall take time to mention only two:

First, a declaration of "Forest Conservation Policy," in part in these words:

> Permanent lumber and other forest-using industries are essential to the national welfare. We recognize the vital relation of forest conservation to the permanency of such industries and their employment. We believe that in forest ownership, operation and renewal, there should continue to be the fullest possible public reliance upon private enterprise and initiative. The lumber industry is encouraging *tree farms* as one means of assuring intensive protection from fire and the application of improved forest management practices on individual properties. The establishment of forestry practices suited to continuous forest production is an obligation of forest owners and of the industries using forest products. Fire prevention and suppression are the major problems in forest conservation. The cooperative and educational approach to national forestry problems should be more fully developed. Research activities of the Federal Government in all forestry fields should be directed toward projects which will definitely aid the practice of forestry on private lands. To retain the maximum possible proportion of forest land in private, tax-paying ownership is a sound national land policy.

Second, from a unanimous action of the Board of Directors, early in this year, in these words:

> The National Lumber Manufacturers Association recommends to forest owners and forest industries, in each State, that they cooperate with appropriate public and private conservation agencies in formulating and seeking the enactment of:
>
> (*a*) State laws that will place *all* forest lands under adequate fire protection as the first essential for continuous forest production;
>
> (*b*) Timber cutting and forest practice rules for continuous forest production, based on the tested experience of forest owners, adapted to conditions in the state and suitable for incorporation into a forestry code to be administered under appropriate state laws; and
>
> (*c*) Where necessary, the establishment or further strengthening of an agency under state law, qualified to administer and enforce the above fire laws and forestry code.

These general declarations of course are important only as, year by year, owner by owner, and state by state, they are converted into effective action. That I think is a primary task in engineering and in public and private cooperation.

In 1938 the Forest Service reported an interesting survey covering 202 million acres of industrial and non-farm forest land. It showed 28 million acres as under some form of management and 137 million acres also as in "productive condition"—a total of 82 per cent. In 1942 the National Lumber Manufacturers Association reported on a survey, in collaboration with the Forestry Departments of thirty-seven states, of 153 million acres of timber lands in private ownership. The reports showed about 16 per cent of these lands as under "carefully planned practices for continuous production of forest crops"; 30 per cent under "satisfactory protection assuring continuous production"; 48 per cent with "reasonably satisfactory reproduction but without sufficient protection from fire"; and 6 per cent totally unproductive. Yesterday I was shown the latest summary report of American Tree Farms showing 705 in ten states with a total area already registered of nearly 10 million acres; and this Tree Farms movement was initiated only three years ago and has had to contend with the diversions and distractions of the war pressures.

This is not a solution. But it is progress. As often has been said: No one knows better than the forest industries themselves how much farther we must go to make America's wood pile secure. I merely say, in the light of observations over a quarter century, that we are on the way.

PUBLIC CONTROL OF CUTTING PRACTICES ON PRIVATE TIMBERLANDS

JOSEPH F. KAYLOR

Maryland State Forester

(Read November 17, 1944, in the Symposium on Forestry and the Public Welfare)

I AM indeed grateful for this opportunity to address the members of the American Philosophical Society on a subject that seems to me of pressing national importance. Our forests are the Nation's greatest renewable natural resource. It has, however, taken the present war, in which wood, either in the form of lumber or of the many varieties of paper products, is rated among the most critical of war materials, to bring home to the American people the immense importance of our forests in the national economy. This importance, moreover, promises to increase, rather than decrease, as time goes on. New chemical treatments that render wood suitable for uses hitherto denied it, development of plastics which have wood cellulose as a base, the great strides made in laminated wood construction, all these promise to make new demands upon the forest, superimposed upon the old. Is it not about time that we took thought as to how the productiveness of our forests may be maintained?

When the history of forest conservation in America comes to be written, record must necessarily be made of the slow but steady increase in public sentiment during the decade which preceded the year 1940 for the public control of cutting practices on privately owned timberlands, and which bore its first fruits shortly after that year in the enactment by the State of Maryland in the East, and by the State of Oregon in the West, of legislation designed to achieve this end. We in Maryland have developed a pattern which we believe will provide answers to some of the questions likely to be propounded by members of the Society.

Americans, with characteristic complacency, firmly believe that it is they themselves who have made this Nation great. It is a compliment ill-bestowed. What has made this Nation great are its natural resources. And greatness will continue only for so long as these remain available in volume. In point of fact, the very Americans who claim credit for their country's dominant position have, over long years, through feverish exploitation without provision for replacement, done what they could to ensure the impairment and eventual destruction of the foundation stones of national wealth and prestige. And in the case of no other natural resource is this more strikingly evident than in that of our forests.

Unlike our mineral wealth which, once taken from the ground, is gone for good, our forests, if rightly used, are self-perpetuating. If wrongly used, their destruction but adds to the sum total of the nation's wasteland, of which we already have far too much. This and a growing knowledge of the important part that forests play in stream control and as a bar to soil erosion account in large measure for the prevailing sentiment that the public should have some say as to how our forest resources are handled. The bulk of our timberlands are today in private ownership, and in all probability will remain there. It follows, then, that it is to such forest areas, vast in extent, that regulation of cutting practices must apply.

As to what public agency or agencies should undertake the regulatory function, there are two opinions. One is that it should rest with the Federal Government, the other, that it is the responsibility of the individual states. But here I should correct myself. Actually, there is a third school of thought, if such it can be called. This may be summed up in the phrase: "there's no need to do anything." It is the plea put forward by individuals and groups at present engaged in woods operations in which no thought is given to provision for future growth. The land is simply stripped and left to its fate, which at best is a precarious one. Here we have the individual pocketbook arrayed against the public welfare. Mature timber should, of course, be harvested. These groups demand, however, that they be left free to harvest it the destructive way, if that will save them some little time and trouble. "A man has a right to do what he likes with his own." Even though it robs the community of potential wealth? Even though it strips the watersheds of protective cover? Even though it turns productive land into unproductive land?

Do not misunderstand me. This attitude is

not that of the progressive timber owner and timber operator today. It is the attitude, however, of groups powerful enough to have been able, in a number of Eastern States, to block legislation in regard to cutting practices similar to that enacted by the State of Maryland. The antidote to the power wielded by such reactionary groups is public education, and still more public education. And, most important of all, effective leadership. In no other way can public sentiment be crystallized to an extent that will make its voice heard and respected.

To return now to the question of Government versus State regulation. The movement for the former heads up, not surprisingly, in the Government itself. In a number of public addresses made in the course of the last two years, Mr. Lyle F. Watts, Chief of the United States Forest Service, and spokesman for the Government in all matters which relate to forestry, states the case in this way:

> Proper forest land use is a matter of national significance with which the Federal Government must be concerned, because timber is such an important item in the national economy. And the watersheds of great streams which provide hydroelectric power to turn the wheels of industry or water to irrigate agricultural crops, do not conform to state lines. Protection of the forests from destructive cutting is as important as protection from fire. And it is just as important for the protection of stream flow as it is for timber production. In order to ensure nation-wide adherance to satisfactory levels of forest practice, the standards for regulation should be established by Federal law.
>
> This does not mean that the States could not administer forest regulations within their borders in accordance with their own procedures and institutions. But it would mean that the local rules of practice adopted by the States should not fall below the standards set up in the Federal law. And the Department of Agriculture (Forest Service) should have authority to act directly in any State which fails to enact suitable legislation and enforce adequate rules of practice.

My own interpretation of Mr. Watts' position and program can be summarized as follows:

1. The Government will set up nation-wide rules of practice, or management standards.
2. States which pass forest legislation that meets these standards, and which administer such laws in a way to ensure their effective application, need not fear Federal regulation.
3. In the case of states which fail to enact legislation that meets Government management standards, or which, when proper legislation is enacted, fail to enforce its provisions, the Forest Service, as representative of the Government, will step in and do the job.

And I am inclined to think that in this matter Mr. Watts stands upon firm ground. If the right use of our forest resources cannot be brought about in one way, it must be brought about in another. A state that would retain its sovereign status must assume those obligations which sovereignty implies. If it does not, its prerogatives must pass into hands willing, even eager, to exercise them, namely into those of the Federal Government. No other choice can be had, nor should be had. And with this I close the Government's side of the case.

In the spring of 1943, the Maryland legislature passed the Forest Conservancy Districts Act, generally known throughout the state as the "new forestry law." This was neither the result of abstract thinking nor of fear of federal encroachment. Rather it stemmed from years of educational work by the Department of State Forests and Parks to acquaint the people of the state with the actual condition of its forest resources. The revenue derived from lumber and other forest products looms large in the state economy. In normal times, this amounts to some $8,800,000 annually, while the capital value of Maryland woodlands, in terms of stumpage, is conservatively estimated at $50,000,000.

As to the present condition of the 2,223,000 acres of these woodlands, surveys show that only about 300,000 acres, or 13 per cent, can be classified as saw timber areas, while 1,125,000 acres, or 53 per cent, produce nothing better than cordwood. The remaining areas, or 34 per cent, are either restocking to tree growth, not always satisfactory, or else have been so badly denuded of such growth as to constitute waste land.

Here is a typical example of the results of years of overcutting, followed by fire, though one by no means confined to Maryland. A sister state to the north, along with many other eastern states, can show similar depletion. Actually, Maryland produces today only one-quarter of the lumber needed by her wood-using industries, which must go outside for the remainder, and on it pay a freight bill of some $3,000,000 annually. Common-sense cutting methods can, eventually, more than double timber production on Maryland's present wooded area. To accomplish that is the principal aim of the Forest Conservancy Districts Act.

In briefest terms, the Act authorizes the Com-

mission of State Forests and Parks, the governing body of the Department of State Forests and Parks, to establish regulations of forest practice on privately owned timberlands throughout Maryland, designed to ensure on such areas at all times a healthy young growing stock of the more valuable tree species; to prevent clear cutting except under certain prescribed conditions; to reduce fire danger; and to prevent tree butchery, as explained a little later on. The Commission is also authorized to appoint district forestry boards of not less than five members to guide the local application of the law's provisions. The district foresters of the Department of State Forests and Parks act as secretaries and executive officers of such boards. Administration of the law is placed with the State Forester.

These are not all the provisions of the law, but they are the principle ones. Under its terms, the Commission of State Forests and Parks has established seven rules of forest practice, which I shall sketch for you briefly: I hardly need say that these, in greater or less degree, are tentative. In a field so completely virgin, it would indeed be a miracle if experience did not call for future revision. Our aim has been, however, and will continue to be, to have as few regulations as possible, and these as simple as possible. This, we believe, is essential to secure compliance without friction. Most of those to whom the law applies are either farmers or sawmill operators, or both, and regulations not readily understandable would be of small effect.

Regulation 1 provides that, after commercial lumbering operations, there shall be left, per acre, one hundred trees from 4.0 to 8.9 inches in diameter 4½ feet from the ground, or twenty trees from 9.0 to 11.9 inches, or eight trees of diameters 12 inches and up, or an equivalent combination of any of these size classes. In addition, all sound, thrifty young trees less than 4 inches in diameter must be left standing, with care taken to prevent their injury during logging.

This regulation is designed to provide at all times an adequate growing stock of young trees of the more valuable species, and calls for nothing more than the practice ordinarily followed by timber owners who aim to keep their holdings continuously productive. It is known as the selective system of cutting, under which mature saw timber is removed periodically, along with crooked, broken, stunted, fire-damaged, and other less promising trees, which are worked up into pulpwood, fuelwood, mine timbers, and other forest by-products. At the same time, those trees that are left obtain the light and space necessary for the most rapid growth.

Regulation 2 deals with an exception to selective cutting that may be made in the case of approximately even-aged stands of Virginia pine (*Pinus virginiana*). This tree is not wind-firm, and under a system of selective cutting, serious blowdown might follow logging. In such cases, the regulation permits modified clear cutting, with clumps of trees, large enough to obviate the danger of windthrow, left to reseed the area.

In several other instances a system of modified clear-cutting seems, for obvious reasons, desirable. As provided for by Regulation 2, these include cases where the timber stand is decadent or so injured by fire, insects, or disease that it cannot be held longer without loss, or where the owner wishes to change over from the present forest type to one better suited to his needs, or where, as in the case of Virginia pine, partial cutting cannot be made without serious risk of blowdown. In each case, modified clear-cutting seems the thing best calculated to protect the owner against loss.

Regulation 3 provides that fuelwood, pulpwood, mine timbers, and posts taken from the stand shall, in so far as practicable, come from sound dead trees, diseased or insect-infested trees or those injured by fire, hardwoods of bushy form, crooked or broken trees or those that are seriously overtopped, trees with unusually large crowns, and those of species not in demand for lumber.

Here, in what is called an improvement cutting, we have a characteristic feature of the selective system. It means that the owner gets a return from everything that grows on his tract; nothing is wasted. It is analogous to the practice followed by the big packing companies, which are said to process every part of a hog except the squeal. And after such material is taken out and sold, the remaining stand, as a source of sawtimber, is in better shape than before.

Regulation 4 has to do with forest protection, especially protection from fire. For a long time the Department of State Forests and Parks has received through its field force a report on every forest fire that occurs in Maryland, and its cause. In the ten year period from 1934 to 1943, for example, reports were made on a total of 13,648 fires. As a result, the Department has a pretty good idea of how fires start, that is to say, who or what is chiefly responsible for them. This has enabled the Commission of State Forests and

Parks, in Regulation 4, to single out some of the danger spots for the application of preventative measures.

In an average year, nearly one-third of all woods fires that occur in Maryland are chargeable to uncontrolled burning of debris and brush, in the course of which fire is permitted to escape to wooded areas. It so happens, moreover, that spring and fall, the seasons when field debris and brush ordinarily are burned, correspond with those of greatest forest fire danger, and extreme care is needed to prevent property damage. The best times of the day in which to burn are the late afternoon and early evening, when wind and moisture conditions make control easiest.

Accordingly, Regulation 4 provides that during the three spring months of March, April, and May, and during the four fall months of September, October, November, and December, controlled burning of debris, brush, and other inflammable material is permissible only after 4 P.M. and before midnight. When the area to be burned is within two hundred feet of woodland or other ground cover that may become ignited, and in the absence of snow or of other natural escape barriers, one required control measure is that the landowner shall plow or otherwise construct entirely around the area a fire line at least ten feet wide, free of all inflammable material. Other control measures, applicable under all conditions, are that the landowner shall supply sufficient help, with tools, to prevent the fire from escaping, and that at least one watchman shall be left on the ground until the last spark is out. Uncontrolled burning in the open is prohibited at all times.

Outside of incorporated cities and towns, which have their own fire regulations, and in the absence of other control measures, house trash will be burned in standard type incinerators whenever these are available or can be procured at reasonable cost. Home-made incinerators are permissible when approved by the District Forestry Board. Each incinerator should have around it a cleared strip at least twenty-five feet wide.

Burning dumps are a common source of woods fires. Ignited material from these is often carried for surprisingly long distances by the wind. Regulation 4 provides that around each private dump shall be established a safety strip at least three hundred feet wide, free of all inflammable material. Owners of private dumps may obtain permission to burn during closed periods, provided that, in the judgment of the District Forestry Boards, this can be done safely. In the case of public dumps, safety measures will be established as the result of negotiation between the District Forestry Board and the town or city concerned.

Another potential source of forest fires is the slash left on the ground after logging. This often becomes tinder-dry and is easily ignited. Regulation 4 requires that such slash shall be scattered, with all tops lopped up as far as a diameter of three inches, to ensure its quick decay. It also stipulates that, except in the case of roads used primarily for access to one or more private properties, all slash shall be removed at least fifty feet horizontally from the property line along a public highway. This last provision is designed to reduce the danger from lighted cigarettes, cigars, and matches tossed into this highly inflammable material by the passing motorist or pedestrian. Many destructive fires have started in this way.

As might be expected, sawmills, which necessarily operate in or near the woods, are responsible for not a few forest fires. Regulation 4 provides that around each mill shall be cleared a safety strip at least one hundred feet wide horizontally, to be kept clear of all inflammable material for as long as the operation lasts. Other requirements are that the mill operator keep on hand a minimum set of fire tools, and that when sawdust, slab, or other mill refuse is burned a metal barrier of a type approved by the District Forestry Board shall be placed around each pile.

These safety provisions represent the least that are likely to prove effective, and entail relatively small expense on the part of mill operators. As a matter of fact, they may well be the means to save the operators the cost of fire-damaged timber on the lands of others. Anything calculated to forestall damage claims should add just so much to likelihood of profits from woods operations.

It should not be assumed from Regulation 4 that brush burning, woods slash, sawmills, and railroads alone are responsible for forest fires. The careless smoker and camper, the incendiary, together are responsible for more than half of those that start. In taking account of forest fire danger spots, the Commission of State Forests and Parks holds that some can be controlled by regulation and some cannot. Among the last, for obvious reasons, are the three just mentioned. In their case, solution of the problem can be found only in public education.

The final section of Regulation 4 provides that landowners who at any time note the presence on their properties of any destructive tree insects or disease shall immediately report the fact to the

District Board or District Forester, in order that the matter may be referred to the proper public agency for the initiation of control measures.

Regulation 5 provides that in lumbering or other forest operations adjacent to public highways, except those used primarily for access to one or more private properties, there shall be left along the road or roads a belt of timber fifty feet in width, from which may be removed only such trees as are marked by a representative of the Department of State Forests and Parks.

Like slash removal, this is a public safety measure, designed to provide a green barrier against fire between main-travelled highways and lumbered areas. Mature sawtimber and trees dead, diseased, or otherwise defective, or those which may for one reason or another prove a danger to traffic, can and should be removed from such strips and will be so marked. An incidental end, but by no means unimportant one, to be attained by Regulation 5 is the preservation of roadside beauty, a most necessary natural asset for any state that aims to attract the outside tourist and to provide its own people with a pleasant place in which to live.

Regulation 6 provides that, if suitable den trees and ground vegetation are already on a tract when it is lumbered, they will be left after logging to provide adequate food and shelter for wild life. It is designed, in the interest of sportsmen and nature lovers in general, to prevent the possible elimination of large areas as the home of game. This is an end earnestly to be desired, and one that can be attained with little trouble and practically no expense.

Regulation 7, applicable in the main to the Eastern Shore, provides that when holly is harvested, only a proportion of the smaller branches will be removed with a pruning shear or lopper, as prescribed by the Department of State Forests and Parks in the case of "certified holly." The use of saws, hatchets, or corn knives in holly stands is prohibited. No healthy holly tree with a diameter less than 14″ D.B.H. (diameter breast high) may be cut for any purpose.

"Tree butchery" by out-of-state dealers, who in late fall invade our holly stands, bids fair, unless checked, to destroy such stands entirely, as has been the case along the eastern seaboard north of us. Holly now brings to Eastern Shore landowners an annual return of nearly one-half million dollars, and provides seasonal employment for as many as ten thousand persons. The cutting methods prescribed by Regulation 7 have proved themselves in practice, and should ensure a permanent supply of this profitable forest by-product.

These regulations jeopardize no private right, unless it be the right to destroy a basic natural resource—and I question whether any such right exists. Nor do they constitute regimentation. They leave wide latitude for individual initiative. They offer no threat that any private business will be taken over or interfered with. Our democracy has not found it inconsistent with the principles of freedom to exercise regulatory authority in, for example, the education of our youth. A father must send his children to school until a certain minimum age, whether he wants to or not. There is no inherent right to ignorance. In the same way, it seems to me that regulation of cutting practices may be viewed as compulsory education in forestry—not the intensive type practiced in Europe, where the forests have been under management for hundreds of years, but the type needed to restore our depleted timber stands to full productiveness. We are faced with a situation that calls for practical methods, to be applied by practical men—but men, withal, who possess a clear conception of the goal they seek.

As for enforcement of the law, that, as may have been gathered by what has gone before, will be carried out principally by education. Any other course would be certain to defeat its own ends. To the extent that available funds will permit, such education will take the form of personal contacts with landowners and sawmill operators by field officers of the Department of State Forests and Parks, the distribution of specially-prepared educational literature, press releases to the county newspapers, and public talks by the State Forester and the various district foresters. Provided your cause is sound, such methods, if carried out with intelligence and perseverance, are bound to achieve results.

Reception of the Forest Conservancy Districts Act by the general public, and especially by timber owners and sawmill operators has, on the whole, been most favorable. The view seems to be that this effort to establish legal standards of forest practice constitutes an extension of public guidance, rather than an encroachment on individual freedom. It was this belief, coupled with the conviction that the time had come to act, which prompted Governor Herbert R. O'Conor to make the forest conservancy law a "must" item on his legislative program for 1943. It marked a long step forward in forest conservation in America.

In the case of the Forest Conservancy Districts

Act, it is much too early to gauge results. Administration of the law was not put into effect until the beginning of the present year, and much time has necessarily been taken up with matters of organization, appointment of district forestry boards, and the like. All I can do now is to give you a brief account of what one small state—small, for instance, as compared with Pennsylvania—has done to set its forest house in order, and incidentally to establish a new trend in legislation designed to protect and to foster one of the prime sources of our national wealth. As "great oaks from little acorns grow," let it be hoped that the course Maryland has set will be followed by other states, in ever increasing number, until the fight for forest conservation is finally won.

THE ROLE OF FEDERAL, STATE, AND LOCAL GOVERNMENTS IN PROMOTING FORESTRY

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GOVERNMENTS can promote forestry by a large assortment of methods. To catalog these would be a tedious undertaking. This paper instead will analyze only some of these methods, perhaps incidentally referring to part of the rest. The ones analyzed are chosen because of timeliness or importance.

Also this paper is confined in the main to the subject of promoting forestry on privately owned lands—on the 185,000,000 acres in farm woodlots, and the 200,000,000 acres in other private ownership in the United States. Since it will be confined to private forestry it will deal mostly with timber management and marketing, and little with other phases of forestry.

Also it will keep as clear as possible of the subject of public control of cutting practices, discussed in another paper, and of regulation in general. Its emphasis will be upon direct public action rather than regulatory legislation.

THE TIMING OF MEASURES

First, a few observations about the order in which different promotional measures are undertaken. Upon wise decision as to what steps to take first, and subsequently in order, will largely depend what progress is made. Two types of consideration are involved in such a decision: first, the results obtained in relation to the effort put in, and second, the state of mind or receptiveness of the forest owners and others affected.

To exemplify the first consideration, a small expenditure of public funds on some program—on fire prevention perhaps—may yield large results; whereas devoted to another program, however essential to really good forestry in this country, it may pay for itself with only a small, and perhaps somewhat uncertain, margin after many years. Public acceptance and support will come much easier if the measures are taken up in the order of their output in relation to input. This is true of public money spent on promoting forestry; it is even more true of measures taken by timber owners on their own holdings.

An analogy drawn from another field may enforce this point. The nutritionists have agreed upon a set of amounts of the different food elements—calories, proteins, and a group of minerals and vitamins—which are essential to a really good diet. One procedure would be to attempt to raise the diets of as many persons as possible, and as rapidly as possible, entirely up to this level. Many nutritionists favor such a course of action. But surely they will make more progress if they first single out the groups in the population suffering severely from lack of simple foods easily obtained, and then go on from there to raise these and other diets to higher levels by means of foods not so easily obtained.

Applying this rule to our forestry problem does not mean, however, beginning with our poorest timber stands. Rather the opposite in many cases, for good timber and good sites tend to pay off the largest results in relation to effort put in.

As for the second consideration in the timing of measures, it is obvious from the papers that have come before that one of the major obstacles to better forestry in this country is lack of public concern and the indifference of woodland owners. This poses for the foresters a difficult problem in social psychology. They must find something in the attitudes and reactions of people at large, and of timberland owners, that they can seize upon that will draw these groups into their programs. They must find the good handle-holds. The measures to take first, unless other factors are more important, are those that have the best handle-holds.

[1]The author was assisted in preparing this paper by his former student, Dr. William A. Duerr, who is now Forest Economist with the Southern Appalachian Forest Experiment Station. Dr. Duerr assembled much of the material and wrote parts of it. Assistance was also rendered by the staff of the Harvard Committee on Research in the Social Sciences. This is Publication No. 11 in the publication series of the Seminar in Agricultural, Forestry and Land-Use Policy in the Littauer School of Public Administration.

From these two points of view, let us now consider various types of measures, putting ourselves in the position of the timberland owners as well as of the public at large.

FIRE CONTROL

First priority among measures, according to these standards, should be given fire control. No major forestry activity now conducted by public agencies rates higher either in acceptability or in economic return than fire protection. Since 1941, under the war stimulus, the federal and state expenditures on fire control have risen from $7,200,000 to $13,750,000. A third of our forests are still without protection, and much of the protected area is not protected enough. But the Clarke-McNary federal authorization for this work was raised from $2,500,000 to $9,000,000 in 1944, and if Congress will make the appropriations and the states will match them, the job can be pretty well done.

Given such protection, the programs outlined in the foregoing stand a fair chance of paying out—without fire protection, only a little chance. It may well be that insurance as well as fire protection will be needed.

Although fire control is acceptable to the general public, it is not always so acceptable locally. In some sections of the country, as in parts of the Southeast, a large task of public education still remains, of breaking down local indifference to, and even acceptance of, uncontrolled woods burning. Here there is the added and difficult job of teaching the fundamental distinction between controlled fire, now widely regarded as beneficial to certain types of forest, and wild fire, which is always at least potentially damaging.

Disease and pest-control measures are, in general, less certain and less precisely developed than fire measures. But some of them yield large returns and by now have become almost as acceptable.

MARKETING ASSISTANCE TO SMALL TIMBERLAND OWNERS

In February 1944 the federal government, in collaboration with the states, was furnishing marketing assistance to small owners in 330 counties out of the two thousand timbered counties in the country. This service is rendered to owners who have a stand of trees ready to be harvested. The farm forester stationed in the county marks the trees to be cut and helps to get competitive bids and to control the manner in which the cutting is done. The results are, one, that growing stock is left on the land, to yield another crop before too long, and two, that the owner gets full value for his timber. The small woodland owner who sells a crop of trees once or twice in his lifetime is in a poor position to know its market value. The author of this paper looked over this type of work on a number of Norris-Doxey projects in 1941. On all those examined, the owners were receiving at least as much for the selective cut as they would have received if the lumberman had stripped the land.

To this type of measure, the writer would assign second priority at this time. It strikes the owner just at the time when he has the keenest interest in his timber, and the highest appreciation of its value, and shows him a way of handling it that will increase its present and future value. Inescapably, at the same time it lays the foundation for a program of forest management for the tract. The owner himself is given a powerful lesson in several major phases of management.

The output-input ratio on such projects runs very high. The Forest Service reports $47,000 spent on this service in the southern region in 1943, resulting in the marketing of $746,000 worth of timber, which was $186,000 more than what the timber would have brought if the owners had sold it themselves. But much more important than this was the value of the stands left after cutting, plus the education of the owner and the awakening of his interest in forest management. Also every one of these jobs becomes a very tangible and impressive object lesson to neighboring timber owners. A very little publicity, mainly in the local press, will make every timber owner in the county fully aware of the possibilities of this type of service.

The Forest Service has estimated that $3,600,000 spent in this way, half to be contributed by the states, will provide this service for the 2,000 timbered counties, and suggests that this be set as a goal to be attained in five to seven years. If such a program is carried out, within fifteen to twenty years very little timber will be sold on any other basis in any of the counties; and a considerable fraction of all the smaller tracts of merchantable, or potentially merchantable, timber will be under some useful form of forest management.

IMPROVEMENT CUTTINGS ON SMALL TRACTS

An important distinction needs to be made, in the approach which we are now taking, between

the cutting of stands of sawlog, pulpwood, and other types of readily merchantable timber, and the removal from younger or inferior stands of the less marketable trees that interfere with the development of good timber. It is the author's observation that more small woodlands come under this latter description than under the first in southern New England, the cutover region of the Lake States, the southern Appalachian Mountains, and many parts of the central hardwood territory. The two kinds of cutting, of course, merge into each other. The cutting of many merchantable timber tracts, if properly done, becomes also a form of improvement cutting. But on more tracts, the trees removed furnish only fuel wood for the farm family, and perhaps a few sawlogs or ties or fence posts.

Obviously the owners of the young or inferior stands are not so easy to reach as the owners of merchantable timber who are looking for a good market. The returns to the former are mostly in the future. These owners can often be shown how to get a little more for the cutting that they do now, but more frequently their reward is only in the improved stands that follow. Nevertheless, many owners of only potentially merchantable stands will be attracted to the cutting being planned by the farm forester in older stands, and will ask what they can do with their timberland. Or it will be an easy transition from showing immediate gains on merchantable stands to demonstrating higher potential gains on younger stands.

Moreover, many of the two thousand so-called timbered counties have relatively little merchantable timber even including good cordwood stands under this head; and the major part of the product to be sold will come from improvement cuttings. The showings that can be made in marketing the merchantable stands in these counties then become highly important, and must be utilized to the full in eliciting the interest of owners of younger stands needing improvement cuttings.

In actual operation, a program of aiding woodland owners with improvement cuttings therefore merges with one of the marketing-assistance type. The second grows out of the first. Therefore not just the second, but both, have high priority. The Norris-Doxey projects should include both.

Just a word about demonstration plots from this point of view. They suffer from the serious handicap that too many people look upon them as show pieces, impractical under actual conditions. People are more influenced by watching an actual woodlot on a neighbor's farm make the transition to a profitable woodland. Demonstration plots therefore do not generally rank high by the test of acceptability, and should be replaced by "demonstration" *woodlots* wherever practicable.

FARM-FOREST AND FOREST-FARM PLANNING

The third stage in the evolution of well-rounded county programs of timber management on small tracts consists of the preparation and use of farm and woodlot plans on farms with woodlots, and similar plans on forest-farming units.[2] These really are plans for the most advantageous utilization of all the land in the holdings. They need to show what parts of a holding should be in each crop-rotation system, what parts in permanent pasture and meadow, and what parts in timber. For the agricultural part of the enterprise, they should show what the crop program is, the layout of the fields used in this program, and the program of pasture management. For the woodland part of it, they should map out the different stands or sites into working units and indicate the plan of management for each. When the plan goes into operation, the disposition of trees to be cut should be determined and these trees marked.

Such complete farm and woodlot planning needs to be distinguished from various forms of partial planning, such as a plan for pasture improvement, or for erosion control, or for an improvement cutting on a particular stand in the holding. Complete planning may, for example, call for establishing trees on a piece of sloping land now in poor pasture, or for plantings on a stump-sprout area in a woodlot. On a majority of small holdings, no thorough job of planning an improvement cutting can be done unless a complete plan for the holding is available for this particular operation to fit into. The cutting on one working unit is likely to be influenced by the plan for the rest of the woodland on the holding. A logical argument can be made for requiring a complete farm plan as a basis for furnishing aid in improvement cuttings and even marketing assistance. But the strategy of this would be poor. Better give the woodlot owner his help in marketing first, and build on this an interest in a weeding, thinning, or improvement-cutting operation later when it is needed;

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[2] If anyone reading this does not recognize this distinction, let it be explained that this enigmatic terminology was developed as an incident to the conduct of the Norris-Doxey projects. Those enterprises in which farm products represent the major source of income are called *farm forests*, and those in which the timber products are the more important are called *forest farms*.

and take advantage of any opportunity when he is really interested, and the farm forester has time for it, to develop the complete plan, or some part of such a plan.

If the farm forester, however, is to do a good job of even partial planning—say, for the present stands taken by themselves, or an improvement cutting on some of the stands—he needs to have as background the results of some complete planning analysis for farm-forest and forest-farm units like those in his county; and it will be best if he himself makes, or assists in making, such plans for some representative holdings in his own county.

Not many such complete farm plans have been made. On the Norris-Doxey projects visited in 1941, only the beginnings were to be found. Some such plans for holdings in Worcester County, Massachusetts, have been made by a group at Harvard University working in cooperation with Massachusetts State College, the Forest Service, the Soil Conservation Service, and the Bureau of Agricultural Economics. One of the young men who worked on these later made such plans for a group of TVA "unit test demonstration" farms in the eastern valley of Tennessee. The Bureau of Agricultural Economics has done some planning of a similar type out of its Atlanta office. And the Kentucky Agricultural Experiment Station, with the United States Forest Service cooperating, is currently making such plans as part of a land-management study in eastern Kentucky.[3]

The planning in Worcester County was done on two levels of intensity. On a group of more than a hundred farms distributed over this large county (sixty-three towns), an attempt was made to determine the combination of dairy and woodland farming which promises to yield the highest combined net return to the family over a cycle of years long enough to bring to full harvest the bulk of the crop trees that would be singled out now as a result of weeding and thinning operations or improvement cutting, and supplemental planting on a few tracts. The incomes from different systems of crop, dairy, and pasture management; from the most promising system of woodland management; and from putting different pieces of land on these farms to crop or pasture use, or pasture or timber use, were estimated on the assumption of prevailing pre-war price levels.

A more intensive job of analysis was done on five of these dairy-woodland farms in one town, and also on three forest farms in the same town. The procedure with the later was as follows: For example, on forest farm No. 1, consisting of 350 acres of land nearly all in some kind of tree or brush covering, incomes were estimated by five-year periods up to eighty years, for two scales of farming operation, and five different intensities of forest management. One scale of farming operation involved keeping four milk cows and providing pasture, hay, and forage for these and the three horses used on the farm and woodland work, as well as providing other food for the farm family. The other involved producing food only for the farm family (with one cow) and hay for the horses.

The combination which promised the largest returns over the whole period included the four cows, "full" treatment on fourteen of the stands, and "partial" treatment on ten of them. The full treatment involves doing all the thinning and improvement cutting required for good silviculture at any period, and handling the cutting in such a way as to come out in the end with all age classes represented by even-aged stands. The partial treatment called for one weeding when a stand was about fifteen years old, a combined thinning and improvement cutting around thirty to forty years, a thinning around fifty-five to sixty-five years, and a final cutting around eighty years. Full treatment did not promise to pay out on the ten poorer sites. On the other hand, applying only partial treatment to the fourteen better stands would reduce the net income greatly and leave the operator with some spare time. With either no treatment at all, or a cordwood system of cropping, this forest-farm would not be able to support the operator and his family. The combination with the four cows pays better than that with only one because, first, some of the land on this holding grows good pasture, hay, and other forage, and returns considerably more per acre so used than in timber, and second, the operator can fit in the labor needed for this much farming without its interfering with his work in the woods.

The amount of silviculture included to best advantage on the five dairy-woodlot enterprises analyzed is partly determined by the proportions of land suitable for cultivation, permanent pasture, and timber on each farm, and partly by the labor supply and the way in which the labor on the two types of operations can be fitted together. Some of the holdings have so large a proportion of land

[3]Dr. Duerr is assisting with this project.

of types normally in timber that only by converting some of the best of this into permanent pasture can enough current income be obtained to carry the enterprise. And on some of the holdings the balance runs the other way. And frequently it is not possible to correct these unbalances by buying or renting more land of the kinds needed: the unbalance exists on most of the holdings in the vicinity.

The TVA plans were worked out jointly by a forester, a farm-management specialist, and a soil surveyor who made a detailed soil survey for each farm. The alternatives tested for the farming operations were different combinations of corn, small grain, tobacco on some farms, red and lespedeza clover, alfalfa and other hays, dairy and dual-purpose cows, and hogs. The principal woodland alternatives analyzed were cutting for fuel wood and other current uses instead of letting the stands mature, converting some of the stands into pasture, and converting some sites from pasture to forest, these often being small sites for the growing of fence posts.

These planning activities are in abeyance now. The young men who were carefully trained for them are in the Navy.

Obviously these plans, like all plans, lean heavily on the future. The relative prices of the different farm products, and of farm and timber products, and the technologies employed, may change much in twenty-five years, to say nothing of longer spans. However, to plan on the basis of the best knowledge of the future we now have, and revise as that knowledge changes, is the only way to bring order into current programs.

Also making such plans clearly calls for a great deal of information about inputs of labor and other factors of production, and about yields of crops at different levels of input, and about rates of growth with different systems of silviculture on different sites. Rarely is all the needed information available. Once planning of this sort is begun, however, research can be directed toward filling the gaps.

Perhaps it needs to be restated that this paper does not propose such complete planning as a basis for all forms of assistance to woodland owners. What has been indicated instead is that those who try to help owners with their forest-management problems need to have such planning analyses made to guide them in their work, and ought whenever possible to assist in the making of such analyses. Most actual planning, for the present at least, will need to be of the partial type.

CREDIT AIDS

Although the three Worcester County forest-farms analyzed promise to pay out, under the right sort of management, in the long pull of 80 years, they will not provide a living for the family for the first forty to fifty years after any stand starts from scratch or near it. Other tracts in the area that might have been studied, have some partly grown stands upon them and would yield some income earlier from thinning and improvement cutting. But most of them in their present condition call for a cumulative investment of labor and capital for a long series of years. Some of the dairy woodlot farms promise enough income from their dairying to support the family and allow spare labor to be invested in the woodlands. On more of them, the dairy income will not suffice. Similar situations prevail on the farm woodlands in a large fraction of the two thousand timbered counties in the country.

Will the owners of these woodlots make the necessary investment of labor and capital? Experience tells us that in a majority of cases they will not. To begin with, a fourth or more of the farms with woodlots are rented, and under existing leases the tenants have no inducement to use any spare labor time in this way. The owners of as many more farms are too insecure, or do not expect to remain on their present farms long enough, to find such an investment attractive. Many others have no time to spare from earning a current livelihood.

To overcome these obstacles in part, the writer has on several occasions proposed the use of a system of credit advances based upon actual work done on woodland improvement. The scheme would work about as follows: First, a plan would be made for the woodlot by a competent forester, which plan would specify the treatments and their timing, and indicate the number of days' labor allowed for each. The work would be done by the farm operator, at the start under careful supervision. Then it would be appraised in terms of the number of days' work done, and the operator would receive an allowance for this, if he needed it, at, let us say, 70 per cent of the prevailing wage in the county. This advance would be a loan against the property offset by its increased value. A special kind of credit instrument would need to be developed, in the nature of a lien on the property, to run until the income from the improvements was realized. It should carry a schedule of repayments as well as of

work to be done and advances. The rate of interest should be very low. By this simple means, plus the supervision and administration furnished, would the public make a contribution proportional to its interest in having woodlands developed.

When this scheme was first proposed, there was severe underemployment on farms. (Five million workers have moved out since 1940 and still farm output has increased a fourth.) Also, farm incomes were still very low. These advances would have put some of the underemployed at work improving their woodlands and would have provided them with much needed current income. Though we may not expect it, we must be prepared for a similar situation in agriculture anywhere from three to ten years after the war. In any event, much rural labor will be released by the mechanization that will follow the war.

The following statement is from a letter recently received from Mr. Lyle Watts:

> With respect to credit for small woodland owners: With the aid of your suggestions, Mr. Marsh and other members of this office gave a great deal of attention some two years ago to the formulation of a plan for liberal credit for small woodland owners not available under existing facilities. We had in mind a large group of small owners, including, for example: (1) Cases where considerable periods (over 10 years) are needed to restore the land to net revenue-producing status; (2) enterprises of which the forest land is a part that are already carrying their full quota of available loans from other sources; or (3) where the woodlands are parts of marginal or unbalanced set-ups which cannot stand normal carrying charges on deferred income investment.

Mr. Watts then goes on to say that further action on this matter was deferred because of the rush of events, but that the Forest Service has recently decided to resume consideration of it.

It has become apparent, at the same time, that similar credit is needed for several other types of land improvements, including drainage, small-scale irrigation works, land clearing, establishing permanent pastures in the South and West, and a whole group of practices now being promoted by the Soil Conservation Service. The period for which some of these need to run is much shorter than on woodlands, and the interest subsidy can be much less.

Before the war, some of the fiscal policy makers of this country developed a great interest in "self-liquidating" investments. They were looking for ways to employ idle capital that would return more than in the numerous PWA and WPA projects that were being conducted. Woodland and other land improvements meet the conditions for such investments almost ideally. In a period of large unemployment, some of them have the further advantage that their contribution to increased output is considerably deferred.

Such a program if developed extensively would obviously call for a large expansion of planning work, and of the analysis needed as a basis for it. Moreover, upon the quality of the plans would largely depend the soundness of the advances. It would be well to ease into such a program, as has been done with the tenant-purchase loans of the FSA.

Such loans should be available for forest farms as well as for farm forests, but would need to be made very carefully if they were to provide a large fraction of the current earnings of the operator. They can also be applied to small timber holdings with families resident upon them, but only after full examination of the conditions of ownership.

One cannot imagine, however, such advances being made in the near future on the hundreds of thousands of small, unoccupied timber holdings that make up the bulk of the timberlands in the East, the Lake States, and some other sections of the country. New England, for example, has 21 million acres of privately owned non-urban land not in farms, and New Hampshire has only one holding larger than 25,000 acres, and twenty-seven larger than 3,000 acres. Maine, with sixteen holdings of 100,000 acres or more, is exceptional. The average size of the timber tracts in five towns in New Hampshire—towns with two to five times as many timber holdings as farms—ranges from 20 to 180 acres. The most common size of nonfarm timber holding in townships in Minnesota is 160 acres.

AREA PLANNING

In areas of this type, and some other types, nothing short of an area plan and organization, perhaps with townships as units, perhaps with counties or even larger jurisdictions, will furnish a basis for a sound plan for woodland development. Such a plan should mark off the timbered tracts of various sizes and decide, on the basis of inventories and analysis, how each can be managed to best advantage. A township in Massachusetts that may serve as an example has one block of 6,250 acres of rough, stony land entirely covered with a poor hardwood stand following after cordwood cutting; one in the opposite corner with

2,100 acres of good sapling growth following removal of old-field pine; and two smaller tracts with mixed stands mostly in the twenty- to thirty-year age class. The rest of the timber land in the town is in farms, but some of these farms do not have enough tillable land to make even minimum incomes possible.

The plan which has been spelled out on paper for this town calls for improving most of the stands on these farms, and also consolidating some of the farms so as to make them into either dairy-woodlot units of sufficient size to yield a reasonable income, or forest-farm units of adequate size. One of the two smaller blocks of timber is to be absorbed into the adjoining dairy farms. The other is to be partly absorbed in this way and partly made into two forest-farm units. The 2,100-acre tract is all to be converted into forest farms and attached to the small farms, with insufficient income, now bordering it. The large tract offers a very difficult problem. It is now owned by eight different persons. The idealized proposal favored by the local town planners is to find some family of sufficient wealth and willingness to engage in a long-range speculative investment, and have it buy out the eight owners and then proceed to develop the tract into a largely hardwood forest, mainly by restocking it. But they are not very hopeful about finding this good fairy.

Getting such a plan carried out is much more difficult than making the plan. For the farm-forest and forest-farm units, the local town planners propose that public agencies make available the services of a farm forester, with such additional help as he may need from time to time; and that long-term credit be made available to finance not only the woodland improvements, but also the recombinations of holdings needed. They realize, however, that many decades at the best will pass before the individual families in the town will be ready or can be induced to make these adjustments; and have wholesome doubts whether half of the needed consolidations will ever be made on this basis.

Some of the plan makers are therefore ready to employ other measures. One proposal, of course, is for the town to buy and develop the 6,250-acre tract as a town forest. Another is that the government develop the leasing program that was discussed a good deal six or eight years ago. Under this program a public agency would lease this large tract, and perhaps the smaller ones, for a period long enough to convert them into mature stands, divide the proceeds from timber sales with the owner, and turn the tracts back into restricted private ownership. This procedure might be difficult to apply to tracts held under several ownerships.

Still another proposal is for the government agency to buy the land outright, reorganize it into economic operating units, make the needed improvements and then sell the land back to a new set of owners, probably under some restrictions. Public ownership would then become merely an interim arrangement made to facilitate a program of reorganization of land use and land improvement. Such a program is already in operation under the Soil Conservation Service on the "land-utilization" projects taken over from the Resettlement Administration. It can become a very useful type of program The principal objection to it is that a large section of the public will not be able to distinguish it from a program of perpetual public ownership, or will fear that it will develop into such a program. This difficulty can probably be overcome, partly by introducing stipulations in the purchase agreements, partly by transferring the lands in present projects back into private ownership as rapidly as possible. Putting the funds available for such projects on a revolving basis might also be helpful.

COOPERATIVES

Area plans may also include provisions for cooperative timber management and marketing. The assistance is likely to include the marking of the trees. It may also include advancing credit to finance the cutting. Actually most of the management assistance thus far given has been provided by extension foresters or other public agencies, the cooperative doing only the selling or bargaining. A few of the cooperatives process their material before they sell it.

It thus appears that the cooperatives now operating have served as intermediaries between public agencies and the woodland owners as well as between them and the buyers. Shortly these cooperatives should begin themselves to perform most of the services to their members. In a way they thus would become something of an alternative to increasing public participation in forest management, whether in the form of voluntary aid, regulation, or ownership.

RELATED AGENCY PROGRAMS

Three other agencies of the federal government developed since 1933 have promoted programs

that have forestry connections; the AAA, the SCS, and the FSA. In 1942, a total of 352,000 acres of timber land were treated to earn benefit payments, the treatment consisting of stand maintenance and improvement, protection against grazing or fire, and tree planting (on 61,000 acres). No guaranty is provided that these improvements will remain in force. The net gain to our forests from the AAA program has been almost negligible. The SCS includes tree planting for ground protection in many of its individual farm plans; also some provision for wild life cover; also considerable attention to upkeep and improvement of farm woodlots. The FSA includes income from, and to a limited extent management of, woodlands in the farm plans that are made as a basis for its loans. This is particularly true on the tenant-purchase farms.

The FCA always has included farm woodlots in its appraisals of farms, and exercises a measure of control over cutting in some of its region. The net contribution to forestry is slight.

It seems clear that an over-all area approach to improving woodlands is needed. Into this the efforts of the disparate agencies could be integrated. Probably this need could be met by "forest conservation districts" similar to the soil conservation districts. But *surely there should not be both in the same area—one district organization should embrace both.* Such a district could implement the area plans described above. Where other types of land improvement are called for, these too should be brought into the same administrative unit—such improvements as drainage, land clearing, establishment of pastures, restoration of grazing land in the West, weed eradication and the like. Some of the western states now make special provision for grazing districts. The state enabling acts for soil conservation districts need to be broadened to include forestry and all types of land maintenance improvement.

LARGE PRIVATE TIMBER TRACTS

Industrial timber holdings and others large enough to be operated as full-fledged forestry enterprises have received even less public aid than have the small holdings. No rationalized policy, comparable to our farm policy, has been developed for large timber holdings. It has been assumed that owners of such tracts are able as a business matter to provide for themselves the forestry consultation they need, and that their size enables them to operate independently as efficient, sustained enterprises. These assumptions have in the past not generally proved to be well founded. The chief aids granted by the public have been fire protection and disease and pest control.

Owners of large forest tracts have in the aggregate contributed substantially to forestry programs, especially in very recent years when public legislative action has loomed as a necessary and less desired alternative. The more than $2,000,000 contributed annually in recent years by private agencies to the Clarke-McNary and related fire-protection programs has come in substantial amount from the larger owners. It has represented about a fifth of the total federal-state-private contribution. The "tree farm" program of the lumber industry, and the forestry work of the pulp industry in the Southeast, are other examples of large-owner enterprise. How lasting these efforts will be cannot be told until markets subside to normal after the war and until the income-tax incentive to liberal operating outlays is somewhat reduced.

Certain it is that owners of large tracts as well as small have fundamental needs that government is justified in serving because of its stake in conservation. The interest rate continues to stand as a prominent obstacle to forestry. Present types of available credit do not meet the needs of large owners, especially those of tracts faced by a considerable regeneration period. Forest insurance is another need currently being studied by public agencies. The local and state governments, on their part, have much to do to improve forest taxation, although the tendency has been to exaggerate the importance of taxation as a deterrent to forestry. There is need for basic local government and property-tax reorganization, and the forests will benefit from this along with other forms of real property. The tax revision in West Virginia in 1939, however, while it bettered the position of the farm woods, threw a relatively heavy burden on industrial forest holdings.

The types of public technical assistance that have been developed with much success for farm woods and other small timber holdings can be applied to larger tracts. The Forest Service has for several years, in cooperation with the states, been doing a kind of extension work with the owners of such tracts, but only $101,000 a year has been available for this purpose. The efforts in this kind of extension are directed, not primarily toward promoting group action, but toward disseminating available information gained through research and experience and toward in-

creasing the income of the property. The emphasis needs to be less upon marketing and more upon management and upon production for the market.

In this connection, a word needs to be said about the place of large timber holdings in forest cooperatives. These are designed primarily to meet the needs of small owners, but a few cooperatives have included one or more large timber owners. These have given them needed stability and security during the early years when the cuttings on the small holdings were uncertain. There appears to be a definite place in cooperatives for large tracts not yet being operated commercially, and the owners of such tracts, especially absentee owners, have much to gain.

Large forest properties operated as parts of industrial enterprises may be handicapped because the lands are not extensive enough to keep the wood-processing plants going on a sustained-yield basis. The last Congress passed a law providing that national-forest lands and intermingled or adjacent private lands may be managed together as sustained-yield units (the cutting practices on all the lands in that case meeting accepted public standards). This type of provision is very desirable, and could be adopted by many of the states as a measure for promoting forestry on large tracts.

OWNERSHIP AS A FACTOR

The way in which timberland is owned, it should be apparent from the discussion, must affect greatly the kind of management it receives, and the role of government agencies in the promotion of good forestry practices. Perhaps the logical way to develop the subject of this paper would have been to present the facts as to ownership at the outset and relate management to ownership at each step. This, however, would have shifted the emphasis away from measures as such. Let us now briefly relate measures to ownership.

First, as to the 185,000,000 acres of timber land reported as within the boundaries of census farms—that is, one or more tracts of land totaling 3 acres or more, under one management, upon which agricultural operations are conducted, or of less than 3 acres provided the value of output is $250 or more. The 1930 census gathered in 6,289,000 of these; the 1935 census, 6,812,000; and the 1940 census, 6,097,000. The differences in these counts were due largely to the number of small tracts with a little agriculture on them that were classified as farms. The 1930 enumeration omitted a large fraction of these.

Of the 6,097,000 farms reported in 1940, only a half are really full family-sized commercial farms. This half delivers nine-tenths of the commercial product of our farms. A half of the remainder are what would be called "smallholdings" in Europe—they do not have enough land resources to use the family labor effectively and to provide the family with a decent income. This group includes the one-mule cotton and tobacco farms of the South. The remaining fourth consists of part-time farms, self-sufficing farms, country homes and estates and the like. Nearly 40 per cent of these 6,097,000 farms are operated by tenants, who have no interest in the woodlands except to get fuel wood and fence posts from them and perhaps a little pasture.

Woodland on commercial farms suffers greatly from grazing in most parts of the country. The woodland on smallholdings could add importantly to the meager incomes of the farm operators if it were well managed; but usually the need for current income is too pressing to permit investments in the distant future. The average part-time farm in the United States has around fifty acres of land. At least two-thirds of this is poor neglected woodland. The self-sufficing farms have even more of such woodland. A few of the owners of country homes and estates have undertaken to put their timberland on a productive basis.

The 200,000,000 acres of nonfarm privately-owned timber land in this country is held by 880,000 owners—an average of 229 acres per owner. Only 0.4 per cent of these owners have 5,000 acres or more. Only 6 per cent of all this land is now on a sustained-yield basis. Another 8 per cent is under "extensive" management. Of the remainder, 68 per cent is restocking itself in some sort of fashion, and 18 per cent is not even doing that.

The most difficult problem confronting foresters is that of promoting good practices by the 800,000 or more timber land owners with holdings of from 10 to 500 acres. In most cases they do not live on their holdings, and many of them live in other states. Why they continue to hold these lands is often difficult to understand. The investment is of course small, and the taxes must be kept light or they will not be paid. Much has become tax-delinquent as it is. For the individual owner of these small tracts to apply intensive management to his isolated tract would be doubtful

wisdom in most situations. The group-wise approach needed can be purely cooperative, or publicly directed, or a combination of the two.

The other alternative is of course public ownership. No attempt will be made in this paper to shed any new light on the issue between public and private ownership of timber land. Only by keeping many large tracts of land in this country in public ownership can the public interests affected be sufficiently protected. Not all of the land answering this description has yet been purchased. The attitude at the moment toward public ownership of land is such, however, that other measures for promoting forestry should receive major emphasis. The acceptability of land-purchase programs is now on a receding tide. With prudent use of the purchase right, the tide will turn again. The most important need for land purchase in the next few decades seems to be, first, to consolidate public timberlands in the most critical public-interest areas, and second, to facilitate timberland reorganization, improvement, and return to private operation. These uses of land purchase must be protected at almost any cost.

THE AMERICAN PHILOSOPHICAL SOCIETY AND THE EARLY HISTORY OF FORESTRY IN AMERICA

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(*Read November 17, 1944, in the Symposium on Forestry and the Public Welfare*)

WHEN the American Philosophical Society commemorated the one hundred and fiftieth anniversary of its foundation in 1893, Dr. J. T. Rothrock, Secretary of the Pennsylvania Forestry Association, and Member of the Pennsylvania Forestry Commission, was invited to read a communication on *The Growth of the Forestry Idea in Pennsylvania*. No better choice could have been made, for Dr. Rothrock was the man who under the auspices of our Society had done pioneer work in Pennsylvania from 1877 to 1893, and he could recall with legitimate satisfaction that this anniversary would appear to be a fitting occasion for a statement of facts concerning "the forest regime which is passing away before a new and better one. Especially is this so when it is remembered how conspicuous a part the Society has taken in bringing the change about."

Despite this statement, forestry was not mentioned again when, a year ago, we commemorated the two hundredth anniversary of the Philosophical Society, an apparent oversight for which we are making now ample amends by devoting a whole session of our meeting to the subject of forestry and experts on the subject are speaking on the different aspects of a subject of national importance.

It was also fitting to delay until this year the consideration of forestry, since William Penn whose tercentenary has just been commemorated is justly considered as a pioneer in the field of forest conservation.

When they retrace the beginnings of the Commonwealth of Pennsylvania, historians never fail to recall a very striking article of the well known document entitled: "Certain conditions and concessions agreed upon by William Penn, proprietary and governor of the province of Pennsylvania and those who are the adventurers and purchasers in the said province, the 11th of July 1681. . . ."

Article XVIII of the contract read as follows:

> That in clearing the ground, care be taken to leave one acre of trees for every five acres cleared, especially to preserve oak and mulberries, for silk and shipping.

If these wise provisions had not been completely disregarded, for reasons to be indicated later, if they had been extended to the other provinces and colonies in America, the conservation problem would never have become acute and disquieting. As a matter of fact, however, they reflected conditions then existing in Europe and have to be interpreted in the light of these conditions. In this particular instance, as is so often the case, American history reproduced at a tremendously accelerated tempo, and in the short space of less than three centuries, age old processes and developments of European civilizations.

I. THE EUROPEAN FOREST

To a large extent the history of the forest coincides with the growth of Western civilization. The old poets had kept the tradition that man was born in the forest and obtained his food from the forest, when, as Lucretius recalled, he was subsisting on wild fruit and acorns. But as soon as he domesticated wild animals, the forest ceased to be the sole source of his support: trees occupied the place that meadows and pastures could more profitably fill and fire was employed to destroy the trees. This work of destruction, this battle of man against the forest grew more intensive when agricultural occupations succeeded pastoral life. Civilization could only progress at the expense of the forest; settlements could only be established in clearings, either natural or made by the hand of man. When these settlements grew more numerous and were connected by paths and roads, trees had to be felled before communications could be regularly maintained. At the same time an ally and an enemy, the forest stood in the way of progress, but when conquered, it provided means of bridging torrents and rivers, of building houses more conveniently and more rapidly than stone huts could be erected and the clearings offered a rich soil, fat pastures, and abundant crops.

With the development of the cities and civil society a new problem arose. Men living close together formed governments, such as they were, lived under certain rules either voluntarily accepted or imposed upon them. A feeling of community grew among them. Not so for those who continued to live in the forest and remained on the margin of human society. Even in the earliest days the forest was consequently invested with a double character.

In case of aggression it offered a ready and inaccessible refuge to the inhabitants of the most primitive village who could take to the woods at a moment's notice. It also afforded a sanctuary to those who refused to abide by the regulations, laws and customs prevailing in a given community, to the lawless people, the bandits and robbers who waylaid the travelers and occasionally raided a settlement, carrying off the women and the cattle of the more peaceful agriculturists.

Thus the forest long retained this double character; it was at the same time a blessing and a curse. It had to be preserved and it had to be destroyed. It was hallowed by the presence of the hermits and sheltered the last remnants of pagan worship. In it lived people who refused to accept the common beliefs of their fellow beings, their code of morality, to worship with them, to build churches and to support monasteries.

From the political point of view the problem was even more complicated. Without lumber no large city and no large houses could be built, and without lumber no large fleet of merchant vessels or war ships could be kept afloat. The forest had to be maintained practically intact as a manifest sign of royal and lordly power and as a game preserve. But cultivated land brought more taxes to the lord, the abbey, and the king and the forest was the only source of supply for ship timber, ship masts, and the whole of the royal navy. With the development of sea power the forest then became a matter of national importance and in some cases of national survival.

With the Renaissance the importance of the problem appeared in all its magnitude. In Italy, the decline of the power of Venice could rightly be attributed to the destruction of forests from which for centuries ship timber had been obtained. The dearth of timber had become so well known and so proverbial in the Mediterranean that when Marcos de Obregon, the hero of Vicente Espinel's picaresque novel, was beaten with cudgels on arriving in Genoa he cried out: "They say there's no wood in Genoa, there's quite enough for me." Less acute but quite disturbing was the situation in France and in England. Hence the regulations passed by Queen Elizabeth in order to reserve the oaks of the forests for the fleet, and in France the regulations promoted by Sully under Henry IV.

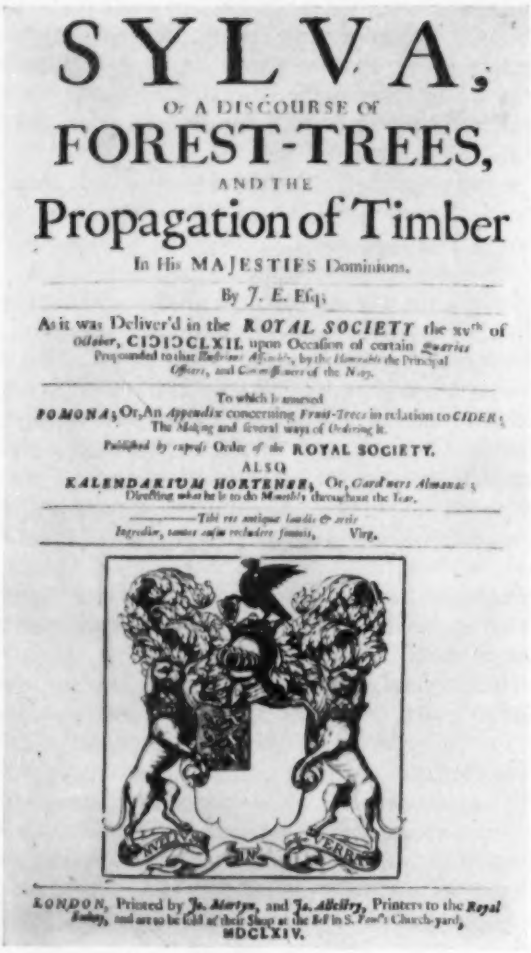
Without going into elaborate details, it may be stated that the problem of the forest came to a climax in France and in England by the middle of the seventeenth century.

In France, the seriousness of the situation was revealed by the investigation on the conditions of the forests undertaken in 1661, by Colbert de Croissy, one year after Louis XIV took hold of the government. The conclusions led up to the famous Ordinance of 1669, establishing a most complete system of supervision, planning, planting, and exploiting in all the forests of the kingdom, including those belonging to churches and monasteries. It was for the kingdom a question of life or death, for as Colbert had tersely stated it: "Faute de bois la France périra," for the lack of wood France will perish.

In England, the situation had become even more critical from the fact that, during a long period of internal troubles, all previous regulations concerning the forests had been disregarded. Old regulations had to be revived and new regulations passed, but it was very characteristically felt that no measure could be effective unless supported by public opinion. It was in order to mobilize public opinion and to appeal to the patriotism of the true Britons that a man who was a scholar as well as a scientist published in 1664, a significant work whose title is most revealing:

Sylva, or a Discourse of Forest-Trees, and the Propagation of Timber in His Majesties Dominions. By J. E. Esq; As it was Deliver'd in the Royal Society the XVth of October CIↃIↃCLXII, upon Occasion of certain *Queries* Propounded to that *Illustrious Assembly,* by the Honorable the Principal *Officers,* and *Commissioners* of the Navy . . . London, Printed by *Jo. Martyn* and *Ja. Allestry,* Printers to the *Royal Society,* and are to be sold at their shop at the *Bell* in *S. Paul's* Church-yard, MDCLXIV.

It was ordered to be printed by the Council of the Royal Society of London for improving of Natural Knowledge, on the 3rd day of February, 1663. The dedication, to "the Kings Most Sacred Majesty Charles the Second," emphasized the importance of the national problem. A learned man as well as an inspired patriot, the



SYLVA,

OR A DISCOURSE OF

FOREST-TREES,

AND THE

Propagation of Timber

In His MAJESTIES Dominions.

By J. E. Esq;

As it was Deliver'd in the ROYAL SOCIETY the xvth of October, CIↃIↃCLXII. upon Occasion of certain Queries Propounded to that Illustrious Assembly, by the Honorable the Principal Officers, and Commissioners of the Navy.

To which is annexed

POMONA; Or, An Appendix concerning Fruit-Trees in relation to CIDER; The Making and several ways of Ordering it.

Published by expreſs Order of the ROYAL SOCIETY.

ALSO

KALENDARIUM HORTENSE; Or, Gardners Almanac; Directing what he is to do Monthly throughout the Year.

——Tibi res antiquæ laudis & artis
Ingredior, sanctos ausus recludere fontes, Virg.

LONDON, Printed by Jo. Martyn, and Ja. Allestry, Printers to the Royal Society, and are to be Sold at their Shop at the Bell in S. Paul's Church-yard, MDCLXIV.

FIG. 1. Title page of John Evelyn's *Sylva*

author, John Evelyn, could have indulged in long and erudite considerations and accumulated a wealth of classical quotations, but he deemed that this was not "the time to philologize."

In the history of European forestry the publication of the *Sylva* marks such an important date and the book itself is so delightfully written that no apology is needed for quoting generously from it. Our only regret is that historians and historians of literature particularly seem to have overlooked a text which should rank at least as a minor classic.

A staunch royalist and loyalist, John Evelyn started with a vehement and indignant account of the destruction of the forests brought about by the former regime. Nor was he little proud of having been operative in preserving at least one beautiful Grove threatened with destruction.

TO THE READER

. . . But shall I then say of our late prodigious *Spoilers*, whose furious devastation of so many goodly *Woods* and *Forests* have left an Infamy on their *Names* and *Memories* not quickly to be forgotten. I mean our unhappy *Usurpers*, and injurious *Sequestrators*; Not here to mention the deplorable necessities of a Gallant and Loyal *Gentry*, who for their *Compositions* (many of them) compell'd to add yet to this *Waste*, by an inhumane and unparallel'd *Tyranny* over them, to preserve the poor remainder of their *Fortunes*, and to find them *Bread*.

Nor was it here they desisted, when after the fate that beautiful *Grove* under *Green-wich Castle*, the Royal *Walk* of *Elms* in St. *James Park*,

*That living Gallery of aged Trees**

(as our excellent *Poet* calls it), was once proposing to the *Council of State* to be cut down and sold, that with the rest of His *Majesties* Houses already demolish'd, and mark'd out for destruction, His *Trees* might likewise undergo the same destine, and no footsteps of *Monarchy* remain unviolated. This is a Truth; which coming by chance to hear of, I so conjured a powerful *Member* of it (and one who was to strike a principal *straoke* in this barbarous *Execution*) that if my Authority did not rescue those *Trees* from the *Ax*, sure I am, my *Arguments* did abate the *Edge* of it. . . .

Thus spake not only the lover of trees and the loyalist but the British patriot who knew that these forests so ruthlessly cut down to satisfy "an impious avarice" had been reserved by

our more prudent ancestors for the repairs of our floating *Castles*, the *safeguard* and boast of this renounced *Island*, when *Necessity*, or some imminent *Peril* should threaten it, or call for their Assistance; and not to be devoured by these Improvident *Wretches*, who to their eternal Reproach did (with the Royal Patrimony) swallow likewise *Gods own Inheritance*.

No more complete picture of the many and vital uses of wood could be found than the *Introduction*, written by a man who did not hesitate to forego the pleasures of the city to proclaim himself "wood-born." There also will be found many expressions which for two centuries were to be used proverbially in England whenever the fleet was mentioned:

Since there is nothing which seems more fatally to threaten a Weakning, if not a Dissolution of the strength of this famous and flourishing *Nation*, than the sensible and notorious decay of her *Wooden-walls*, when either through *time negligence*, or other

*Mr. Waller's Poem of St. *James* 's Park.

accident, the present *Navy* shall be worn out and impaired; it has been a very worthy and seasonable Advertisement in the Honourable the principal *Officers* and *Commissioners,* what they have lately suggested to this *Illustrious Society,* for the timely prevention and redress of this intollerable defect. For it has not been the late increase of *Shipping* alone, the multiplication of *Glass-works, Iron-Furnaces,* and the like, from whence this impolitick diminution of our Timber has proceeded; but from the disproportionate spreading of *Tillage,* caused through that prodigious havock made by such as lately professing themselves against *Root* and *Branch* . . . were tempted, not only to sell and cut down, but utterly to grub, demolish and raze, as it were all those many goodly *Woods,* and *Forests,* which our more prudent *Ancestors* left standing, for the Ornament and service of their Country. And this devastation is now become so *Epidemical,* that unless some favourable *expedient* offer itself, and a way be seriously, and speedily resolv'd upon, for the future repair of this important *defect,* one of the most glorious, and considerable *Bulwark* of this *Nation,* will within a short time be totally wanting to it.

In his eagerness to have the necessary "expedient" adopted and to convince all classes of readers, John Evelyn resorted to all the tricks of the propagandist, going as far as to relate anecdotes of dubious authenticity but significant and consequently legitimate. Such is the story attributing to the Spanish the intention of employing scorch the earth tactics, if ever they landed in England:

I have heard, that in the great *Expedition* of 88, it was expressly enjoin'd the Spanish *Commander* of that signal *Armada,* that if when *landed* they should not be able to subdue our Nation, and make good their *Conquest*; they should yet be sure not to leave a *Tree* standing in the *Forest of Dean;* it was like the *Policy* of the *Philistines* when the poor *Israelites* went down to their Enemies *Smiths* to sharpen every man his *Tools*; or, as they said *lest the Hebrews make them Swords, or Spears;* so these, *lest the English build them Ships, and Men of War:* Whether this were so, or not, certainly it is, we cannot be too *jealous* for the preservation of our *Woods*; and especially of those eminent, and with care inexhaustible *Magazines* (p. 108).

He did not neglect either to call on the lovers of nature to add their voices to the arguments presented by the patriots.

There is nothing more expos'd, wild, and less pleasant than the common *Roads of France* for want of shade, and the decent *limits* which these sweet, and divertissant *Plantations* would have afforded . . . since doubtless such noble and agreeable objects would exceedingly divert, entertain, and take off the *Minds* and *Discourses* of *Melancholy* people, and pensive *Travellers,* who having nothing but the dull and enclosed ways to cast their eyes on, are but ill *Conversations* to themselves, and others (p. 27).

Among the various trees to be specially preserved the oak receives the first place. John Evelyn becomes truly lyrical, and more intensely British than ever, when enumerating the uses of this wood and comparing it with the varieties grown in other countries:

For all of which our *English Oak* is infinitely preferrable to the French, which is nothing so *useful,* nor comparably so strong; insomuch as I have frequently admir'd at the sudden failing of the most goodly *Timber* to the Eye, which being employ'd to these Uses does many times most dangerously flie in sunder, as wanting that native *spring* and toughness, which our *English* Oak is indu'd withall (p. 15).

In his conclusion, John Evelyn undertook to answer more definitely the queries propounded by the Commissioners of the Navy and to recommend measures "for the preservation and improvement of woods" and forests. There again, he took particular care to flatter the national pride of his readers. Refusing to look abroad for precedents and regulations and turning back to measures already adopted in England, he advocated that "the prudent Sanctions of our Parliaments" be revived. He particularly praised "the 13 and 27 of Q. Elizabeth, cap.25, 19 etc" and singled out "the *Act* exempting *Timber* of 22 years growth from *Tythe*" recommending to extend the exemption "for a longer period to render it compleat and more effectual to their improvement" (p. 108). As an additional measure he also proposed "that every *twenty Acres* of *Pasture* made an allowance for *Half* an *Acre* of *Timber,* to be planted in a *clump,* well preserv'd and *fenc'd* for 14 or 15 years" (p. 116), thus combining conservation and reforestation.

He realized, however, that his plea and all the measures advocated by the Royal Society might be powerless and unable to defeat a new power then arising in England. In his own days a new factor had appeared threatening even more extensive destruction of the English forests. He had witnessed the beginning of that industrial revolution, the full impact of which was to be felt only almost two centuries later. The first effect of the increase in the production of iron and steel, however, had been to increase noticeably the consumption of wood and the destruction of the forest, since charcoal was then exclusively used in the

iron mills. Evelyn felt that no effort of the conservationists and no patriotic consideration would be of much avail against the demands of the rising new industry. In his despair he turned his eyes towards America. This was the subject of his ninth recommendation:

> That the exorbitance, and increase of devouring *Iron-mills* were looked into, as to their *distance* and *number* neer the Sea or navigable *Rivers*; And what if some of them were even remov'd into another *World*? 'twere better to purchase all our Iron out of America, than thus to exhaust our Woods at home (p. 109).

This was no idle dream but a very practical measure which would redound to the profit of all the parties concerned, since in America the forest was a hindrance to the development of the settlements and not an asset, and the detestable breed of the iron makers and industrialists would be encouraged to expatriate themselves and join their brethren on the other shore of the Atlantic, while old England would import the iron she needed from abroad and would utilize her forest resources in building a mighty fleet. Here again we shall quote from the old author:

> I am inform'd that the *New-English* (who are now become very numerous, and hindred in their advance and prospect of the *Continent* by their surfeit of the *Woods* which we want) did about twelve years since begin to clear their *High-ways* by two *Iron-mills*; I am sure their zeal has sufficiently wasted our stately *Woods*, and *Steel* in the bowels of their *Mother* old *England*; and 'twere now but expedient their *Brethren* should hasten thither to supply us with *Iron* for the peace of our days; whilst his Majesty becomes the great *Sovereign* of the *Ocean*, free *Commerce*, *Nemorum Vindex*, & *Instaurator magnus* (p. 116).

If we now remember that Sir William Penn, Penn's own father, was an admiral and a close friend of John Evelyn, it will be seen that in writing Article XVIII of his "certain concessions and conditions," the founder of Pennsylvania had probably in mind the interests of the mother country as well as the future of the colony.

It happened however that such restrictions and regulations could hardly apply in a new country: conditions being different, different ways of dealing with the forest had to be found.

It had taken Western Europe over two thousand years to conquer the forest and to reach a point when it was realized that it was more profitable in the long run to exploit and even "cultivate" the woods than to destroy them and that the forest constituted a regular crop to be husbanded.

America was to pass through the same stages in something less than two centuries and a half. However history did not exactly repeat itself, although it might be maintained that the history of the American forest reveal some neglected aspects of the long contest of man against the forest in the Old World.

II. THE FOREST PRIMEVAL

The first prerequisite for a modern student of history who might entertain the ambition to trace an accurate picture of the policy pursued by the first colonists would be to eliminate as far as possible the poetical notions gathered from such romantic, sentimental, lyrical or epic writers as Fenimore Cooper, Longfellow, Bryant, Whittier, Thoreau, Whitman, not to mention among the more recent John Muir, Bret Hart, or even Stewart Edward White. Almost twenty years ago, a student of literature, Miss Dorothy Anee Dondore, wrote a splendid study on *The Prairie and the making of Middle America: Four Centuries of Description*, Cedar Rapids, 1926. A survey of *The Forest and the Making of The Eastern United States* would be no less revealing; but, as in the case of the Prairie, it would be found that the legend and literary tradition sharply differ from reality. Writing at the beginning of the nineteenth century, a Virginia poet who had all the affectations and faults of an eighteenth century poet, Daniel Bryan, exclaimed in the *Preface* to his *Mountain Muse, Comprising the Adventures of Daniel Boone*, Harrisonburg, 1813:

> Indeed the physical beauty and magnificence, combined with the moral and political enjoyments of this Land of elysium are well calculated to inspire with poetic devotion, the bosom which has any native predisposition to the indulgence of imagination. Who, that has a soul susceptible of ennobling sensations, can ramble thro Columbia forests, hear the roar of her rivers, gaze on the grandeur of her mountains, and muse on her glorious Liberties, without breaking forth into the rhapsodies of divinest enthusiasm?

The first colonists and their immediate successors were not so predisposed, and the early memoirs, relations, and documents tell a very different story.

To the old historian of New Hampshire, Jeremy Belknap, who wrote in 1784, the history of the part of the country with which he was familiar could be summed up in three words: fur, fish, and

lumber. After the fur traders, came the fishermen and after the fishermen the real settlers who engaged in a mighty battle against the primeval forest without which they could not build the shelter and houses they needed, but which they could not preserve without accepting to live in a semi-savage condition. To quote from the same historian, the forest had to be "subdued" before it could be turned into pastures and arable land, for the forest was the wilderness in which lurked Indians, savage beasts, and unknown dangers. The land had to be cleared and, in addition to fire, two weapons were to be used constantly in the battle against the rank vegetation which covered the Eastern shore, the ax and the grubbing hoe.

This however was not the official attitude of the colonial government and more particularly of the colonial governors. In his *History of the Lumber Industry of America,* 2 v., Chicago, 1907, James Elliott Defebaugh has gathered many documents indicating that, in the earlier days of the colonies, regulations were passed concerning field and forest fires. Twenty years later, Professor Robert G. Albion in his classic study on *Forests and sea power, The timber problem of the Royal Navy,* Cambridge, 1926, has reviewed the measures taken by the British government to reserve for the Royal Navy masts and timber for its use and to restrict cutting (Chapter VI, "The broad arrow in the colonies"). But both Defebaugh and Albion agree that these measures were "most of the time futile and objected to by the colonists who wanted to use their own property to the limit."

Many different factors contributed to this ruthless destruction of the primeval forest. Only a few can be indicated here and the whole of the colonial period could be studied from this special angle. Timber was much in demand in the cities, as it was the only fuel then known, and large quantities were needed for dwellings. But to a certain extent timber was only a by-product. Before cities could be built, it was necessary to clear the land, to bring it under cultivation and to produce food for an ever growing population. And so the work of deforestation went apace with the growth of the settlements. But to restrict the picture to this aspect of the development of the colonies would be unfair to the early settlers.

At a very early date, the pioneers ceased to be satisfied with the work of destruction. Wild trees had to be destroyed, but fruit trees had to be planted. It is very significant that as an appendix to his *Silva,* John Evelyn published a *Pomona,* an enthusiastically written treatise on fruit trees and orchards. In a similar manner the colonists were anxious to acclimatize in their new abode productions from the motherland and even from other countries. To the Old World they were sending seeds, seedlings, and plants but from England, the European continent, and the West Indies they were bringing new varieties of plants and trees. And so an alternative current soon was established between the Old and the New World from the start of the colonies. During the eighteenth century these exchanges became much more systematic. The natural channel was between the colonies and England, but the English botanists kept in close touch with botanists and horticulturists on the continent. The flow of scientific information and agricultural exchanges between London and Paris was never interrupted even in time of war. Here I shall only mention two instances and two names which are of particular interest to our Society.

It is well known that the main business of John Bartram was to collect plants and seedlings to send to his London correspondents, Fothergill and Collinson. It is not so well known, perhaps, that Benjamin Franklin acted as a sort of silent partner in the undertaking. When he went to London for the first time, in an official capacity, he took along with him boxes of seeds entrusted to his care by Bartram and saw to it that they were properly delivered. He took this scientific mission so much to heart that, in one instance at least, he went out of his way to satisfy his friends and engaged in a transaction which in our days would be deemed trading with the enemy. The Revolution had naturally interrupted communications between the United States and the old metropolis, much to the distress of the French who were thus unable to obtain from their English correspondents the botanical and horticultural material which was much in demand on the continent, while the British horticulturists themselves keenly felt this interruption in the free exchange of seeds and plants. A letter written by the American plenipotentiary to John Bartram and published by Darlington (*Memorials of John Bartram and Humphrey Marshall,* Philadelphia, 1849) reveals the ingenious method he devised to overcome the difficulty.

PARIS, May 27, 1777.

My dear old friend:—

The communications between Britain and North America being cut off, the French botanists cannot

in that channel, be supplied as formerly with American seeds, &c. If you, or one of your sons, incline to continue that business, you may, I believe, send the same number of boxes here, that you used to send to England; because England will then send here for what it wants in that way. Inclosed, is a list of the sorts wished for here. If you consign them to me, I will take care of the sale, and returns, for you. There will be no difficulty in the importation, as the matter is countenanced by the ministry, from whom I received the list.

My love to Mrs. Bartram, and your children. I am my dear friend,

Yours most affectionately,

B. FRANKLIN.

Even more interested than his grandfather in the importation of new plant species was William Temple Franklin. From a whole series of documents preserved in the Library of our Society in the Franklin papers, I shall only mention the letter written to William Temple by Le Veillard on November 19, 1786, to accompany a shipment of:

10 pêchers mignone, 2 pêchers galande, 4 pêchers magdelaines, 4 pourprées hâtives, 5 tétons de Vénus; 15 abricots pêches; 20 pommes d'api; 20 poiriers bon chrétien and 10 cressane; 100 peupliers d'Italie; 20 pieds de vigne chasselas, 10 muscats blancs, 2 rouges, 2 alexandre and 6 violets.

The item concerning the hundred Italian or Lombardy poplars deserves particular mention since this special variety of very rapid growth was well adapted to city planting and Franklin himself, in a letter written from Paris to Hopkinson, on December 24, 1782, had recommended planting "two rows of them in every one of our streets."

Both Franklin and the Philosophical Society of Philadelphia were directly interested in the undertaking started by Humphrey Marshall whose catalogue marks an important date in the history of botanical exchange. It was presented primarily as a scientific publication under the following title:

Arbustrum Americanum: The American Grove, or an An Alphabetical Catalogue of Forest Trees and Shrubs, Natives of the American United States—Arranged according to the Linnaean System. Containing, The particular distinguishing Characters of each Genus, with plain, simple and familiar Description of the Manner of Growth, Appearance, etc. of their several Species and Varieties. Also, some Hints of their uses in Medicine, Dyes, and Domestic œconomy. Compiled from actual knowledge and observation, and the Assistance of Botanical Authors, by Humphrey Marshall. Philadelphia. 1785.

The dedication of the catalogue read as follows:

To Benjamin Franklin, Esquire, President—John Ewing, D.D., William White, D.D., and Samuel Vaughan, Esq. Vice Presidents, and to the Other Members of the American Philosophical Society. This Alphabetical Catalogue of the Forest trees and Shrubs, Native of the American United States is respectfully dedicated by the Author.

In cauda venenum, the real purpose of the catalogue was expressed in a post scriptum in form of *Advertisement*:

Boxes of Seeds, and growing Plants, of the Forest Trees, Flowering shrubs, etc. of the American United States, are made up in the best manner and at a reasonable rate by the Author. All orders in this line, directed for Humphry Marshall, of Chester County, Pennsylvania; to the Care of Dr. Thomas Parke in Philadelphia, will be carefully and punctually attended to.

Four copies were sent by Franklin to Le Veillard to be given to Messrs de la Rochefoucauld, de Malesherbes, de Barbançon and himself (*Franklin papers*, October 22, 1786) and a French translation was published in Paris in 1788).

No less significant of the interest taken by the Philosophical Society in these botanical exchanges had been the publication in the first volume of the *Transactions* of *A Catalogue of the Foreign Plants, as are worthy of being encouraged in our American Colonies, for the Purpose of Medicine, Agriculture and Commerce. From a pamphlet by John Ellis, F.R.S. presented by the Honourable Thomas Penn Esq. to the American Philosophical Society, thro' the hands of Samuel Powel, Esq.* (Vol. I, p. 266.)

Jefferson's efforts in the same direction and his contribution to these botanical exchanges are too well known to warrant more than a bare mention here. In any case, it would suffice to refer to the recent publication of *Jefferson's Garden Book (1766–1824)*, by Professor Edwin Morris Betts, *Memoirs*, Volume 22, of the American Philosophical Society, Philadelphia, 1944.

No wonder Valmont de Bomare in his *Dictionnaire raisonné d'histoire naturelle* published at the end of the eighteenth century remarked that many exotic plants from Canada and Northern America were found not only in the King's Garden, but had been naturalized and grew spon-

taneously in Burgundy, in Italy, and everywhere in France. And among those he mentioned particularly "the Virginia oak, or live oak, very sturdy and growing in any kind of soil as demonstrated by Mr. de Buffon."

III. THE FOREST AND THE HUMAN HABITAT

The history of America is characterized by such dynamism, changes are so continuous and so rapid that any attempt to draw a still picture of any period and to analyze its biological complexity is doomed to be both incomplete and extremely unsatisfactory. In terms of time the history of the American people is a sort of condensation of European history, while in terms of space it extends over a practically unlimited territory, instead of being confined within well-established and more or less stable historical or geographical frontiers. The result is that at any given moment we can observe developments happening here simultaneously which in Europe were separated by long chronological intervals. While the battle against the forest was taking place on the frontier, the settlements suffered very early from the dearth of wood, at a time when wood was not only an essential building material but the only fuel used in industry and for heating houses. Without any hope of unravelling this tangled skein we shall simply endeavor to indicate some of the tendencies which manifested themselves before the close of the eighteenth century.

As early as 1742, the situation in Philadelphia had become critical enough to attract the attention and stimulate the inventive genius of Benjamin Franklin. His first scientific or philosophical paper, published in 1744, gave "An account of the new invented Pennsylvania fireplace," the purpose of which was a better utilization of whatever fire wood was then available. In the preliminary paragraphs of his paper Franklin presented considerations worth recalling:

> In these northern colonies the inhabitants keep fires to sit by generally seven months in the year; that is, from the beginning of October to the end of April, and, in some winters, near eight months, by taking in part of September and May.
>
> Wood, our common fuel, which within these hundred years might be had at any man's door, must now be fetched near one hundred miles to some towns, and makes a very considerable article in the expense of families.
>
> As therefore so much of the comfort and conveniency of our lives, for so great a part of the year, depends on the article of *fire*; since fuel is become so expensive, and, as the country is more cleared and settled, will of course grow scarcer and dearer, any new proposal for saving the wood, and for lessening the charge and augmenting the benefit of fire, by some particular method of making and managing it, may at least be thought worth consideration.

The conclusion is no less worthy of attention, for Franklin stated there the true problem of forest conservation, the solution of which was not to be sought in the wholesale preservation of the wilderness, but in an equilibrium between forest growth and the consumption of wood, however mistaken he may have been in believing that in Europe such an equilibrium had been reached:

> The mentioning of those northern nations puts me in mind of a considerable use of these fire-places. It is observable that, though those countries have been well inhabited for many ages, wood is still their fuel, and yet at no very great price: which could not have been, if they had not universally used stoves, but consumed it as we do in great quantities, by open fires. By the help of this saving invention our wood may grow as fast as we consume it, and our posterity may warm themselves at a moderate rate, without being obliged to fetch their fuel over the Atlantic; as, if pit-coal should not be here discovered (which is an uncertainty) they must necessarily do.

The last statement will strike the modern reader as strange, and it takes a strong effort of historical reconstruction to see eye to eye with these Philadelphians of 1742 who were seriously contemplating the possibility of importing coal from England and were still unware of the existence of their own coal fields. Franklin was no less mistaken in his optimistic views of the supposed equilibrium attained by the nations of Europe. Forty years later, after witnessing during several winters the distress of the Parisians he modified his early invention and adapted it to new conditions and to the utilization of a new fuel still in its experimental stage when, aboard the ship which was taking him back to America, on his last voyage, he wrote and sent to, J. B. Leroy, his fellow member of the Académie des Sciences, his *Description of a new stove for burning pitcoal and consuming its smoke*. But even the discovery of the coal fields and the growing use of coal in heating houses and in foundries had failed to solve the problem of the forest.

Wood was still essential not only for building purposes but for national defense. Nothing could

be substituted in the building of ships, for the oak and particularly the live oak offered more than any other wood of the twisted and prefabricated shapes without which no seaworthy vessel could sail the ocean. Timber had to be hauled one hundred miles; much came from the Chesapeake, New Jersey and even Georgia and Florida. In the case of small vessels, it had even been found more economical to build boats in the midst of the forest and then haul them to the water with teams of fifty or eighty oxen, and float them down the river to Philadelphia or New York, according to the location.

Considered from this point of view, the problem was fairly simple and conservation was in order; but other factors introduced unexpected complications.

It had been suspected for a long time in Europe that the absence or presence of forests exerted an influence on the climate; but even if in Europe deforestation had proceeded at an accelerated pace, during the more modern period, the total changes were comparatively so slow as to be almost imperceptible.

In America, on the contrary, large spaces were laid bare when a new plantation was established and the colonists built their dwellings in surroundings which had been suddenly transformed by the hand of man. It did not take them long to notice that this change in the climate had some influence on their health and that a close relationship existed between the forest and health conditions. Unfortunately they did not agree upon the nature of that relationship. In a letter dated May 12, 1688, and addressed to the Royal Society of London, John Clayton gave "An account of several observations in Virginia and in his voyage thither, more particularly concerning the air." He could not too strongly condemn the Virginia practice of clearing a new piece of land every three or four years:

> Those that have 3000 Acres, have scarce cleared 600 Acres thereof, which is peculiarly term'd the Plantation, being surrounded with 2400 Acres of Woods; so that there can be no free or even motion of the Air, but the Air is kept stagnant or the lofty Sulphurous Particles of the Air, that are higher than the top of the Trees, which are above as high again as the generality of the Woods in England, descending, when they pass over the cleared spots of Ground must needs in the violent Summer, raise a preternatural Ferment, and produce bad Effects. (*Miscellanea Curiosa. Containing a Collection of Curious Travels . . . as they have been delivered in to the Royal Society* III: 314, London, 1708.)

In "Some Thoughts and Experiments concerning Vegetation," John Woodward, M.D., of the College of Physicians upheld before the Royal Society a very different view. After conducting methodical experiments on the growth of plants, during the years 1691 and 1692, he came to the conclusion that:

> This so continual an Emission and Detachment of Water in so great Plenty from the Parts of Plants, affords us a manifest Reason why Countries that abound with Trees, and the larger Vegetables especially should be very obnoxious to Damps, great Humidity in the Air, and more frequent Rains, than others that are more open and free. The great Moisture in the Air was a mighty inconvenience and annoyance to those who first settled in *America*; which at that time was much overgrown with Woods and Groves. But as these were burnt and destroy'd, to make way for Habitation and Culture of the Earth, the Air mended and clear'd up space, changing into a Temper much more dry and serene than before. (*Miscellanea Curiosa* I: 220.)

However unscientific may have been the observations and conclusions of John Clayton and Dr. Woodward, we may at least retain the important fact that long before America was considered as a gigantic laboratory in which were conducted political experiments on an unprecedented scale, it already stood in the eyes of European scientists as a country in which could be observed, under most favorable conditions, phenomena which belonged to the historical past of Europe and could not be reproduced at will. The American colonists themselves undertook very early to accumulate as many observations as they could on the climate of the various regions of the colonies. By the time the American Philosophical Society was revived and was officially recognized, it was generally admitted that the climate of America had undergone within man's memory "very observable changes," and "that our winters are not so intensely cold nor our summers so disagreeably warm as they have been." Such at least was the general remark made by people who had resided long in Pennsylvania and the neighbouring colonies, which prompted Dr. Hugh Williamson to read before the American Philosophical Society on August 17th, 1770 "An attempt to account for the change of climate which has been observed in the Middle Colonies of North America."

Unlike their successors who are wont to repeat that everybody complains about the climate, but nobody does anything about it, the colonists had made the marvelous discovery that in cut-

ting down the forests, in bringing large areas under cultivation, they had brought about such changes in the seasons that they were now able to cultivate crops which were unknown to their predecessors. They felt that a new power had been placed at their disposal. In Europe, the inhabitants had always accepted the climate as it was and more or less successfully had attempted to adapt themselves to surrounding conditions. In America, the colonists had actually created a new climate and modified natural conditions to such an extent that they felt they could modify it practically at will. They had mastered and conquered forces of nature to which their European ancestors had to yield and submit. More than a scientific communication, Dr. Williamson's paper was a paean of victory: to a certain degree it also was a prophecy:

A considerable change in the temperature of our seasons may one day oblige the tobacco planter to migrate towards the Carolinas and Florida, which will be the natural retreat of that plant, when the seasons admonish the Virginian to cultivate wheat and Indian corn. The tender vine, which would be destroyed by our winter's frost, in a few years shall supply the North American with every species of wine. Posterity will doubtless transplant the several odoriferous, aromatic and medicinal plants of the eastern countries, which must flourish in one or another part of North-America, where they will find a climate and soil favourable to their growth, as that of their native country.

This marvelous transformation and further transformation to be expected, all could "fairly be deduced from the cultivation of the country." But, being a medical practitioner, Dr. Williamson was even more interested in the remarkable improvement in the health of the colonists that had resulted from these climateric changes. Most if not all of them could be traced to the increase in the cultivated area and the corresponding decrease in the superficies of the forest. If in making his point he used a more scientific language he was no less enthusiastic than in presenting the first part of his paper.

Every friend of humanity must rejoice more in the pleasing prospect of the advantages we may gain in point of health, from the cultivation of this country, than from all the additional luxuries we may enjoy, though both the Indies were brought to our doors. The salutary effects which have resulted from cleansing and paving the streets of Philadelphia, are obvious to every inhabitant. For causes somewhat similar to these, the general improvement of the colonies have already produced very desirable effects. While the face of this country was clad with woods and every valley afforded a swamp or stagnant marsh, by a copious perspiration through the leaves of trees or plants, and a general exhalation from the surface of ponds and marshes, the air was constantly charged with a gross putrescent fluid. Hence a series of irregular, nervous, bilious, remitting and intermitting fevers, which for many years have maintained a fatal reign through many parts of this country, but are now evidently on the decline. Pleuretic and other inflammatory fevers, with the several diseases, of cold seasons, are also observed to remit their violence, as our winters grow more temperate. (*Transactions* **1**: 345.)

Thus was revived in Philadelphia, before the American Philosophical Society, the issue which had attracted the attention of the Royal Society of London, at the end of the seventeenth century. But this time the approach was entirely different; it was no longer an academic or purely scientific question. The whole future of the country depended on the solution given to the problem, and we shall see later that it received due consideration on the part of the "philosophers." Nor was the interest aroused by these changes in the climate of the colonies limited to Philadelphia. At the very time Dr. Williamson delivered his paper, a young Virginia lawyer began to make scientific observations on the temperature and the winds from his "mountain-top" of Monticello and to compare his results with those obtained by Dr. Madison who was President of the college located at Williamsburg. Although in his *Notes on Virginia,* Jefferson entered some of these observations, we must seek elsewhere for a more elaborate treatment of the question. It is to be found in the account written by Chastellux of the visit he paid to Jefferson. It will be seen that Jefferson favored a moderate solution which would have established and maintained a sort of equilibrium between the cultivated and the woody areas. It was only after comparing notes and a long discussion that the French general and philosopher and the American "farmer" who had already made his mark in the history of his country agreed on two points. The first was that with the progress of population and agriculture certain sea wind now reached Williamsburg which before was not felt there, and also:

That nothing is more essential than the manner in which we proceed in the clearing of a country, for the salubrity of the air, nay even the order of the seasons, may depend on the access which we allow

the winds, and the direction we may give them. It is a generally received opinion at Rome, that the air is less healthy since the felling of a large forest situated between that city and Ostia, which defended it from the winds known in Italy by the names of the *Sirocco* and the *Libico*. It is believed in Spain also, that the excessive droughts, of which the Castilians complain more and more, are occasioned by the cutting down of the woods, which used to attract and break the clouds in their passage. There is yet a very important consideration upon which I thought it my duty to fix the attention of the learned in this country, whatever diffidence I may have of my own knowledge in philosophy, as well as on every other subject. The greatest part of Virginia is very low and flat, and so divided by creeks and great rivers, that it appears absolutely redeemed from the sea and an entire new creation; it is consequently very swampy, and can be dried only by the cutting down a great quantity of wood; but as on the other hand it can never be so drained as not still abound with mephetical exhalations; and of whatever nature these exhalations may be, whether partaking of the fixed or inflammable air, it is certain that vegetation absorbs them equally and that trees are most proper to accomplish this object.* It appears equally dangerous either to cut down or to preserve a great quantity of wood; so that the best manner of proceeding to clear the country, would be to disperse the settlements as much as possible, and to leave some groves of trees standing between them. In this manner the ground inhabited would be always healthy; and as there yet remains considerable marshes which they cannot drain, there is no risk of admitting the winds too easily, as they would serve to carry off the exhalations. (*Travels in North America, in the years 1780–81–82*, 232–233, New York, 1827.)

Meanwhile, the Philadelphia doctors continued to disagree on the influence of deforestation upon public health. Contrary to the opinion expressed precedently by Williamson, Dr. Benjamin Rush, in a paper read before the American Philosophical Society, December 15, 1785, maintained that "Pennsylvania for some years past has become more sickly than formerly." He traced the change to two main causes: (1) the establishment and increase of mill-ponds; and (2) the cutting down of wood, which under certain circumstances tended to render a country sickly:

> It has been remarked that intermittents on the shores of the Susquehannah have kept an exact pace with the passages which have been opened for the propagation of marsh effluvia, by cutting down the wood which formerly grew in the neighbourhood. I remember the time, when intermittents were known only within half a mile, in some places, of that river. They are now to be met within ten miles in the same parts of the state.

At that point, Rush introduced an important distinction between clearing and *cultivating* a country:

> While clearing a country makes it sickly in the manner that has been mentioned, *cultivating* a country, that is, draining swamps, destroying weeds, burning brush, and exhaling the unwholesome or superfluous moisture of the earth, by means of frequent crops of grain, grasses, and vegetables of all kinds, renders it healthy. I could mention, in support of these facts, several countries in the United States, which have passed through each of the states that have been described. The first settlers received these countries from the hands of nature pure and healthy. Fevers soon followed their improvements, nor were they finally banished, until the higher degree of cultivation that have been named took place.

According to Rush the remedy to be applied varied according to circumstances—neither wholesale conservation nor wholesale deforestation were to be advocated. Around mill-ponds, trees were to be planted, for "it has been demonstrated that trees absorb unhealthy air, and discharge a highly purified air in the form of what is now called deflogisticated air." On the other hand when forests were cut down care should be taken "to let the cultivation always keep pace with the *clearing* of our lands. Nature has in this instance connected our duty, interest and health together. Let every spot covered with moisture from which the wood has been cut, be carefully drained, and afterwards ploughed up and sowed with grass seeds." (*Transactions* 2 (25).)

The same position was taken ten years later by William Currie in his paper entitled: "An Enquiry into the cause of the Insalubrity of flat and Marshy Situations; and directions for preserving or correcting the Effects thereof," read before the Society, October 2, 1795. Following Rush's recommendations, he insisted upon the danger of clearing the woods "without draining off the stagnant water at the same time." He recommended complete cultivation and at the same time "planting rows of trees near the marshes or mill ponds and near mansions, because they supply a constant supply of oxygen to the atmosphere." (*Transactions* 4 (14).)

This seemed a practical and sensible solution, resting on experiments carried out by Lavoisier and Priestley and, on the whole, in complete agreement with the best scientific theories of the

*This discovery the world owes to Dr. Franklin.

time. Perhaps it was too "modern" for the time and not strictly orthodox; it smacked of infidelity, since it reflected the views of men like Dr. Priestley, whose theology was at least questionable. What right had man to change what God had wrought and to transform the face of the earth? Such was the point of view defended by Dr. Seybert, M.D., in a paper read on December 1st, 1798, and entitled "Experjments and observations, on the atmosphere of marshes." The following quotation will illustrate the point of view of the old fundamentalist and traditionalist who had attempted to enlist science in the service of theology:

> Heretofore mankind seem to have viewed their existence as noxious to them and unnecessary to their happiness. I confess my former opinion respecting them coincided perfectly with that of the majority, but at present my ideas are very different: I consider them as very necessary to keep the atmosphere in a *proper degree* of purity, for it is not only the impure atmosphere which kills animals, but the too pure also; and an ingenious philosopher has well observed, that animals live too fast in atmospheres overcharged with oxygen gas. They appear to me to have been instituted by the Author of Nature in order to operate against the powers which vegetables and other causes possess of purifying the atmosphere, so that the oxygen may exist in a proper proportion, fit to support animal life and combustion. I am of the opinion that ere long marshes will be looked upon by mankind as gifts from Heaven to prolong the life and happiness of the greatest portion of the animal kingdom. Perhaps it was originally intended that they should remain uninhabited and that their only use should be that of correcting the too pure atmosphere. Although their immediate inhabitants suffer disease from them, still but a small portion of the human race choose marshy situations as their residence. (*Transactions* **4** (14).)

It has not been possible to ascertain to what extent this extreme view was shared by lovers of the established order in Philadelphia. Dr. Seybert himself admitted that his opinion did not coincide with that of the majority. We may surmise, however, that he did not stand absolutely alone since his paper was approved for publication and printed in the *Transactions* while many others remained unpublished in the archives of the Society. Perhaps it was simply thought that the *Transactions* were a proper repository for papers representing different and conflicting views. In any case the effect and influence of Seybert's theory was amply counterbalanced by another communication "On the Mode most easily and effectually practicable of drying up the Marshes of the Maritime parts of North America. By Thomas Wright, Licentiate of the College of Surgeons in Ireland and Teacher of Anatomy," read before the Society on November 21, 1794, and printed in the same volume of the *Transactions*.

Dr. Wright had served as a surgeon with the British forces during "the American war (here so called)," and his men had suffered from "the intermittents" no less than the inhabitants of Philadelphia and the people of Virginia. An observing man, he had noticed, contrary to Dr. Seybert, that fevers prevailed in the vicinity of swampy lands, that strong winds which swept the atmosphere and cleared it of miasmas seemed to have a salubrious effect on the general health of the soldiers, and he had come to the conclusions that it was both necessary to drain the marshes and to clear the country of woods in order to promote evaporation. This was a gigantic undertaking which could not be carried out in a short time, and yet the need of establishing healthier conditions was imperative if the country was to develop. Wright was probably acquainted with the observations made by Bishop Madison and Jefferson and consigned in the *Notes on Virginia*. It could not be doubted that already deforestation and cultivation had modified the regime of the prevailing winds. What had been effected as a result of unsystematic and haphazard developments could very well be attempted again, and Dr. Wright did not doubt that the climate of large sections of the country could be modified at will. Although he was not an American, the method he proposed was bold enough to appeal to American imaginations:

> Let it be supposed that the N.W. and S.E. are the *asseclae* or prevailing winds of North America; let the surveyor general mark out a tract of say 100 or 200 miles in a right line to be cleared of trees; then every blast from these two opposite points will ventilate 200 miles of country, bearing along the fumes of all the marshes, while the great vista or avenue skirted with woods at both sides would furnish the most salubrious and consequently valuable situation for settlers. (*Transactions* **4** (29).)

This was deforestation combined with sanitary engineering on a grandiose scale. But this was more than a wild flight of scientific or philosophical imagination. By the end of the eighteenth century, people in America, and among them the philosophers who held their meetings in Philadelphia, had come to realize that for better or worse man was able to modify the climate in which he

lived and that natural conditions could be altered by man's handiwork. This was not a theory, but a well recognized fact and such changes could be observed throughout the country; they were particularly sensible in the new settlements. Traveling from North to South and from East as far West as settlements then extended, the French philosopher and geographer Volney summed up his observations in a book which for many years was authoritative and can still be consulted with profit, *A View of the soil and climate of the United States of America . . .* By *C. F. Volney, Member of the Conservative Senate, etc., etc. Translated with occasional remarks by C. B. Brown.* Philadelphia. 1804.

On the authority of Jefferson, Samuel Williams, the historian of Vermont, Peter Halm, La Rochefoucauld Liancourt, and many others, Volney, who was a member of the Society and had attended the meetings when in Philadelphia, admitted that:

> Longer summers, later autumn, shorter winters, lighter and less lasting snows, and cold less violent, were talked of by everybody; and these changes have been described not as gradual and slow, but as quick and sudden, in proportion to the extent of cultivation.

He had been able himself to witness such a change happening with a dramatic suddenness in the scarcely settled region of Kentucky. There, the people "already begin to complain of an aridity, which keeps pace with the clearing of the country, and completely dissipates the fond illusions of travelers and land speculators." And he added:

> It is commonly believed, in Kentucky, that the springs have become more abundant, since the woods have been removed. . . . It is nevertheless true, that the moisture of the atmosphere, and the copiousness of springs in general, are diminished, especially upon the higher grounds, by the destruction of the woods, by which the condensation of the vapours is lessened or prevented. Kentucky itself, as well as the other states, continually affords proof of this, in a multitude of brooks, which have not been drained within five years, but which are in want of water every summer. Many of them have wholly disappeared, and several mills, in New Jersey, have been abandoned on this account (p. 22).

To entertain any doubt on the matter was no longer possible: "these partial changes have taken place in the climate of the country, which have shown themselves in proportion as the land has been cleared."

Changes in the climate, sometimes beneficial and, at other times, already threatening distress and even disaster, had taken place. Man had modified his milieu to an unprecedented degree; it remained to determine to what extent these changes had reacted on man himself and his ways of living.

IV. THE FOREST AND HUMAN SOCIETY

Our attitude towards nature has been so profoundly, so unconsciously and so generally affected by two centuries of romantic productions, that historians, and particularly historians of ideas, who deal mostly with literary material, experience considerable difficulty in attempting to reconstruct the state of mind of men who, chronologically close to us, were living in surroundings entirely different from the modern scene. It has become axiomatic that close contact with nature is essentially desirable and beneficial; city dwellers yearn for a few weeks vacation when, in a forest, which they fondly believe might be primeval, they may roam and sleep in the shady aisles of the cathedral of Nature. This feeling, so strong in our days, has always manifested itself whenever civilization has become more complicated and more oppressive, and has always existed in the hearts of those who revolted against the restraints and constraints of society.

It was far less general, and was even exceptional as a genuine feeling, in countries and times where and when men realized that their very existence and survival depended upon the strengthening of a precarious social organization. Among the early colonists there were undoubtedly adventurers and rebellious characters, but those were not the true founders and builders of America. The men who tamed the wilderness and created a new civilization in a new world were socially minded; their ambition was to establish a well-knitted society and as Professor Schlesinger has so aptly showed in a recent article, they were at the same time pioneers and "joiners." (*American Historical Review,* October 1944.)

It is this yearning for society, so strongly marked among the colonists, which made them scornful of those who were living in the woods. When St. John Crèvecœur published in London, in 1782, his *Letters from an American Farmer,* he attempted in the third letter, entitled *What is an American?* to define the essential characteristics of the new people and of the recently born nation. He was the first, as far as I have been able to discover, to point out that, if in America

the old class distinctions had practically disappeared, new distinction had arisen. "Men are like plants," wrote Crèvecœur; "the goodness and flavor of the fruit proceeds from the peculiar soil and exposition in which they grow." According to this system he could distinguish in America three divisions in the people: Those who lived close to the sea and were interested in trade, commerce, navigation, and manufactures. Those who lived in the middle settlements, close to the land, but were masters of their destiny, free men and freeholders, interested in politics and spiritual matters. They were the farmers, the salt of the earth, the class of people in whom Jefferson put his faith. Then came a last class of men, living isolated in the wilderness, outcasts and outlaws who conducted a constant battle against the wilderness and the forest, the "off-casts" of society. Of their way of living and moral degradation Crèvecœur drew a dark and impressive picture:

> Now we arrive near the great woods, near the last inhabited districts; there men seem to be placed still farther beyond the reach of government, which in some measure leaves them to themselves. How can it pervade every corner; as they were driven there by misfortune, necessity of beginnings, desire of acquiring large tracts of land, idleness, frequent want of economy, ancient debts; the re-union of such people does not afford a very pleasant spectacle. When discord, want of unity and friendship; when either drunkedness or idleness prevail in such remote districts; contention, inactivity, and wretchedness must ensue. There are not the same remedies to these evils as in a long established community. The few magistrates they have, are in general little better than the rest; they are often in a perfect state of war; that of man against man, sometimes decided by blows, sometimes by means of the law; that of man against every wild inhabitant of these venerable woods, of which they are come to dispossess them. There men appear to be no better than carnivorous animals of a superior rank, living on the flesh of wild animals when they can catch them, and when they are not able, they subsist on grain. He who would wish to see America in its proper light, and have a true idea of its feeble beginnings and barbarous rudiments, must visit our extended line of frontiers where the last settlers dwell, and where he may see the first labours of settlement, the mode of clearing the earth, in all their different appearances; where men are wholly left dependent on their native tempers, and on the spur of uncertain industry, which often fails when not sanctified by the efficacy of a few moral rules. There, remote from the power of example and check of shame, many families exhibit the most hideous parts of our society. They are a kind of forlorn hope, preceding by ten or twelve

FIG. 2. A scene of pioneer life. From Roux de Rochelle, *Etats-Unis d'Amérique*, Paris, 1837.

years the most respectable army of veterans which come after them. In that space, prosperity will polish some, vice and the law will drive off the rest, who uniting again with others like themselves will recede still farther; making room for more industrious people, who will finish their improvements, convert the loghouse into a convenient habitation, and rejoicing that the first heavy labours are finished, will change in a few years that hitherto barbarous country into a fine, fertile, well regulated district. Such is our progress, such is the march of the Europeans toward the interior parts of this continent. In all societies there are off-casts; this impure part serves as our precursors or pioneers. . . . Forty years ago this smiling country was thus inhabited; it is now purged, a general decency of manners prevails throughout, and such has been the fate of our best countries.

With Crèvecœur this was no passing mood, but the very core of his rural philosophy which was also the philosophy of Thomas Jefferson. Only those among the historians of literature who have never read the *Letters from an American Farmer* can continue to propagate the legend that Crèvecœur was strongly influenced by Jean-Jacques Rousseau. The frontier man who was "but a feller of tree" and whose "distresses" were described at length in the twelfth letter of Crèvecœur, had nothing in common with "l'homme tel qu'il est sorti des mains de la nature" and nature was neither generous nor even indifferent towards him.

No less categorical was Jeremy Belknap, in his *History of New Hampshire*, published between 1784 and 1792, despite his own love of the forest and his lyrical descriptions. He had to admit that on the whole forestry was "a risky business to be encouraged only inasmuch as it does not interfere with cultivation, which, after all, is much preferable to the lumber business both in point of gain, contentment and morals." (I: 156.) True enough, "the contractors and agents made large fortunes by this traffic; but the laborers who spent their time in the woods, and were supplied with provision and clothing for themselves and their families, anticipated their earnings, and were generally kept in a state of poverty and dependence." (I: 150.)

It remained for Benjamin Rush to draw a complete picture of the march of civilization on the new continent. It will be found in his *Essays, Literary, Moral and Philosophical*, published in volume form in Philadelphia, in 1798. This particular essay was entitled "Information to Europeans who are disposed to migrate to the United States of America. In a letter to a friend in Great Britain," dated Philadelphia, April 16, 1790. This was a much more elaborate and more penetrating treatment of a topic already familiar to the Society.

Speaking before the Patron, Vice-President, and Members of the Philadelphia Society, Timothy Matlack had extolled in 1780 the virtues and unrewarded courage of the early settlers, those lost soldiers of civilization:

The first settlers of Pennsylvania, full of English Ideas of Farming, cleared little Patches of Land with infinite Labor, cutting up every Tree and Grub by the Root, until they broke their Hearts with the Labor—and when they had done, new and fertile as the Lands were, they hardly obtained themselves Bread. Their Labor was Herculean. Many were discouraged and Numbers actually returned to England. The poorer Settlers, urged by Necessity, ventured to sow and plant in Fields, from which the Timber was cut down and burned—and some hastily girdled trees and sowed their Grain, expecting but little increase. (*Oration delivered March 16, 1780*, Philadelphia, 1780.)

Rush's picture was much more complete and critical. As a document dealing with the social history of America it is even more important than Crèvecœur's letter, although it seems to have been entirely ignored by modern historians and was not even cited by title in Frederick J. Turner's authoritative book on *The Frontier in American History*. (New York, 1921.)

Rush started with a distinction which has to be kept in mind whenever the frontier is studied:

The business of settling a new tract of land, and that of improving a farm, are of a very different nature. The former must be effected by the native American who is accustomed to the use of the axe and the grubbing hoe, and who possesses almost exclusively a knowledge of all the peculiar and nameless arts of self preservation in the woods.

This letter was supplemented by an even more important "Account of the progress of population, Agriculture, Manners, and Government in Pennsylvania."

According to Rush,

The first settler in the woods is generally a man who has outlived his credit or fortune in the cultivated parts of the State. . . . He is a migrant; breaks the ground, then moves on. . . . His exertions, while they continue, are violent; but they are succeeded by long intervals of rest. His pleasures consist chiefly in fishing and hunting. He loves spirituous liquors, and he eats, drinks, and sleeps in

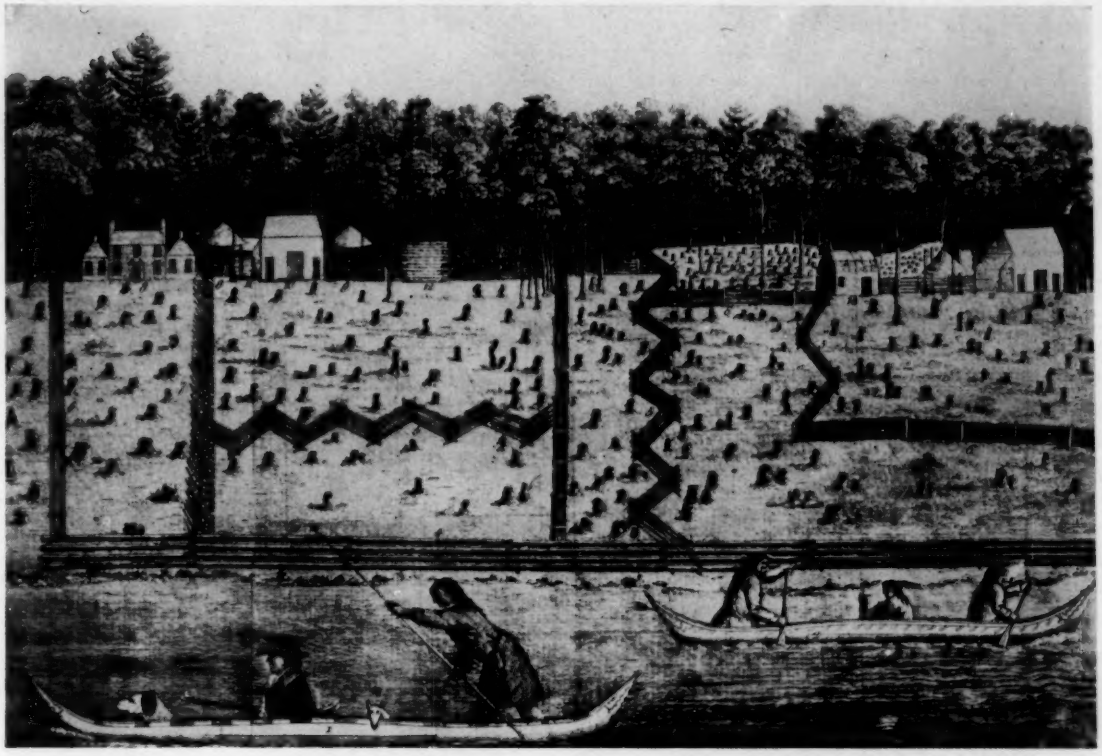


FIG. 3. Illustrating the different kinds of buildings on a well appointed farm in the woods and different types of fences: (4) log fence; (5) worm fence; (6) post and rail fence; (7) Virginia rail fence. From P. Campbell: *Travels in the interior parts of North America in the years 1791 and 1792.* Edinburgh, 1793.

dirt and rags in his little cabin. Above all, he revolts against the operation of the laws. He cannot bear to surrender up a single natural right for all the benefits of government,—and therefore he abandons his little settlement, and seeks a retreat in the woods, where he again submits to all the toils which have been mentioned. There are instances of many men who have broken ground on bare creation, not less than four different times in this way in different and more advanced parts of the State.

The second settler is somewhat more steady: he is a man of some property, "he pays one third or one fourth part in cash for his plantation," but if he is socially minded he is not yet sufficiently aware of his responsibilities to society:

> he neglects to contribute sufficiently towards the building of a church . . . he is equally indisposed to support civil government with high ideas of liberty, he refuses to bear his proportion of the debt contracted by the establishment of our country: he delights in company—sometimes drinks spirituous liquors to excess—will spend a day or two in every week, in attending political meetings; and thus, he contracts debts, which compel him to sell his plantation generally in the course of a few years, to the third and last species of settler.

It is to that third species only "that it is proper to apply the term of *farmers.*" It is only with them "that we behold civilization completed." Thanks to the unrewarded efforts of his predecessors the forest has been tamed, the trees cut down, the wild shoots grubbed, the stumps burned down and the roots dug out; the land now is ready for cultivation, for a more thickly settled population that will enjoy the benefits of social life and social organization. It was this third class Jefferson had in mind when he praised the "farmers"; they have nothing in common with the unfortunate and dissolute vanguard which made their coming possible. On them rests the prosperity and the stability of the nation. Here again one must quote:

> The third settler must be viewed as a conqueror, The weapons with which he achieves his conquests, are the implements of husbandry; and the virtues which direct them, are industry and œconomy. Idleness—extravagance—and ignorance fly before him.

Happy would it be for mankind, if the kings of Europe would adopt this mode of extending their territories: it would soon put an end to the dreadful connection which has existed in every age, between war and poverty, and between conquest and desolation.

This peaceful conquest had nevertheless been accomplished at the expense of the forest and had been preceded by a very extensive destruction of the woods. Such was the price that had to be paid. It cannot be said that at the end of the eighteenth century many Americans thought it to be too high. The back woods extended almost indefinitely: the main problem remained not conservation, but extension of the cultivated area in order to provide food for a rapidly increasing population. Even the most clearsighted and farsighted philosophers were not ready to make a firm stand for conservation. When, in 1792, Thomas Jefferson was asked by Peter Carr whether he thought that they could not apply in Virginia the English law of waste, which prevented "any deterioration of the land, such as cutting down forest, which in England is an injury," he answered in a very dubitative manner that: "we might argue in Virginia, that though the cutting down of forest in Virginia is, in our husbandry, rather an improvement generally, yet it is not so always, and therefore it is safer never to admit it." (*Memorial edition* VIII: 384.)

It would be difficult to maintain that this answer reveals in Jefferson an ardent champion of the trees. The same equivocal position is found in Tench Coxe's *View of the United States of America, in a series of papers written . . . 1789–1794,* Philadelphia, 1794. The title of the second chapter is very significant: "Reflections upon the best modes of bringing the forest lands of the United States into cultivation and use." It is only after enumerating all the possible uses of wood, and all the profit that can be derived from

FIG. 4. View of Bethlehem a Moravian Settlement. A model settlement "most agreeably situated on a rising ground"; "the town is regularly laid out . . . the country for many miles round Bethlehem is most pleasantly diversified with rising grounds; the soil is rich and better cultivated than any part of America I before saw." From Weld's *Travels* II: 355. Part of the original forest has been preserved; the walks are planted with trees and hedges substituted for fences.

the destruction of the forest that as an afterthought, Coxe recommends "the proper preservation and reproduction of our forest" without specifying the measures to be taken in order to protect the remaining trees against ruthless and thoughtless destruction.

Up to that date the American Philosophical Society had taken no definite stand on the question of conservation. In the choice of papers for publication the special committee had obviously been governed by the spirit of the rule printed at the beginning of Volume IV of the *Transactions*:

> That the grounds of the Committee's choice of papers for the press, should always be the importance or singularity of the subjects, or the advantageous manner of treating them, without pretending to answer, or to make the society answerable, for the certainty of the facts, or propriety of the reasonings, contained in the several papers so published, which must still rest on the credit or judgment of their respective authors.

On one instance, however, the Society had departed from the letter of the rule when it was decided to publish as an *Introduction to Volume The Third of the Transactions,* "An Essay on those inquiries in Natural Philosophy, which at present are most beneficial to the UNITED STATES OF NORTH AMERICA. By Dr. Nicholas Collin, Rector of the Swedish Churches in Pennsylvania. Read before the Society the 3d of April 1789."

It is a remarkable document illustrating the true humanism and universalism of our predecessors: "Philosophers," wrote Collin at the beginning of his paper, "are citizens of the world; the fruits of their labours are freely distributed among all nations; what they sow is reaped by the antipodes, and blooms through future generations." But at the same time it was a program, an enumeration of the various subjects which should retain the attention of the philosophers, as well as a philosophical profession of faith. No better and more complete summary of the state of scientific knowledge in America at the end of the eighteenth century could be found anywhere. As was to be expected, Dr. Collin gave a whole chapter to the "Inquiries relative to rural œconomy." To Collin and to most of his contemporaries, agriculture was the great civilizing force and undoubtedly the philosophers agreed with him when he declared that "It is pleasing to see how fanaticism declines with agricultural improvement in many new settlements; and how refinement of public manners keeps pace with a preference of enlightened teachers." This being the case, and agriculture being also "the principal source of prosperity and wealth, to prefer other objects, however useful in a secondary view, would be perverting the order of nature, nay, opposing the will of nature's God."

But fond as he was of agriculture and eager as he was to list among his desiderata "an apparatus for clearing new land, which ought to be a compound of coulters, saws, axes, and screws so that trees may be pulled out of the ground, cut in convenient pieces, and heaped," this dream or vision of the modern bull-dozer did not prevent him from advocating cultivation rather than destruction and proposing a series of measures for the conservation of the American forest. I shall give only here the most essential parts of his plea:

> The vast domains of the United States can vie with any country in the variety, utility, and beauty of trees and shrubs. Our stately forests are a national treasure, deserving the solicitous care of the patriotic philosopher and politician. Hitherto they have been too much abandoned to the axes of rude and thoughtless wood-choppers. What person of sense and feeling can without indignation behold millions of young oaks and hickories destroyed, to make bonfires in open smoaky houses, or trucked in the cities for foreign toys! some parts of Europe were thus laid waste in former centuries; and the present generations must with great labour and expense repair the ravages of their forefathers. In many parts of this country a preservation and encrease of the timber for fuel and domestic uses renders these queries important.—What trees are of the quickest growth? at what age do they encrease most? what is the proper distance between them? what is the best mode of pruning, for promoting the growth, and taking off all superfluous branches? what kinds are suitable to different soils? what species thrive best together? a judicious lopping of the branches, thinning close the clumps of trees, and clearing the ground of underwood, will make many woodlands good pastures, and form them into beautiful parks. This management would also improve the quality of timber by procuring the benefit of sun and air: the want of this may be regarded as one principal cause of the spunginess of our timber, which defect so inimical to durability, strength, and preservation of a given form, is further encreased by a too common ignorance or neglect of the proper season for felling the materials of building, furniture, staves, and various utensils. . . . Finally we may sincerely wish that the owners of venerable woodlands might regard them as principal ornaments of their country; and while they clear a part for the purposes of agriculture, leave those hills crowned

FIG. 5. "The progress of a Western pioneer hewing out of the howling wilderness an abode of civilized comfort . . . with fire, axe and oxen." Note the shape of the axe and the shallow roots of the trees. From *Harvey's scenes in the primeval forests of America, engraved from his original paintings*, George Harvey, London, 1841.

with towering pines, and stately oaks; suffering likewise the groves of tulip-trees and magnolias to wave among yellow harvests and blooming meadows. In some of the old countries many gentlemen would purchase such rural charms at any expense, but must wait till the evening of life for their plantations; is it not then deplorable, that so many American farmers daily destroy what their offsprings of better taste will deeply regret! this evil might in a great measure be lessened by a *treatise on ornamental* planting adapted to the present circumstances of this country.

As far as I have been able to find out this is the first document frankly and unequivocally dealing with forest conservation and marshalling all the arguments which could appeal to the cultivator of the earth, including the esthetic argument. As such it deserves a place of its own in the history of American forestry and it is no little credit to our Society that it originated in this Hall and appeared in our *Transactions*. A year later, when writing his "Information to Europeans who are disposed to migrate to the United States of America," dated from Philadelphia, April 16, 1790, Dr. Benjamin Rush, remembering Dr. Collin's paper did not forget to mention that,

if a settler in the woods should possess a taste for rural elegance, he may gratify it without any expense, by the manner of laying out his farm. He may shade his house by means of ancient and venerable forest-trees. He may leave rows of them standing, to adorn his lanes and walks—or cluster them on the high grounds of his fields to shade his cattle.

This is a far cry from the so-called romantic attitude towards nature and yet it is the attitude most commonly found amongst men who, living close to nature, were above all eager to enjoy the benefits of society and civilization. Even the few of them who recognized the strange fascination of the wilderness refused to yield to the dangerous charm, with the possible exception of William Bartram, who nevertheless was more fond of smiling landscapes and Elysean scenes than of the "awful shades" of "the high forests."

Something of the same feeling, however, appears in Jeremy Belknap's *History of New Hampshire* which would deserve a separate study and should occupy a high rank among the early painters of the American scenes. Passionately fond and proud of his native State and region, eager to justify the climate and the air of his mountains against the charges made by "European writers," the old divine protested that "the tall and luxuriant growth which an European might call 'rank vegetation,' not only indicates strength and fertility of soil; but conduces to absorb noxious vapours." (III: 173, 2nd ed., Boston, 1813.) On one occasion at least, although not a poet, he felt and expressed the charm of the Northern woods and, were it only for this reason, should be granted some recognition by students of American literature:

Notwithstanding the gloomy appearance of an American forest, yet a contemplative mind may find in it many subjects of entertainment. The most obvious remark, is the silence which reigns through it. In a calm day, no sound is heard but that of running water, or perhaps the chirping of a squirrel, or the squalling of a jay. Singing birds do not frequent the thick woods; but in every opening, made by the hand of cultivation, their melody is delightful.

Another thing, worthy of observation, is the aged and majestic appearance of the trees, of which the most noble is the mast pine. The tree often grows to the height of one hundred and fifty, and sometimes two hundred feet. It is straight as an arrow, and has no branches but very near the top. It is from twenty to forty inches in diameter at its base, and appears like a stately pillar, adorned with a verdant capital, in form of a cone. Interspersed among these, are the common forest trees, of various kinds, whose height is generally about fifty or eighty feet. In swamps, and near rivers, there is a thick growth of underwood, which renders travelling difficult. On high lands, it is not so troublesome; and on plains, it is quite inconsiderable.

Amidst these wild and rugged scenes, it is amusing to observe the luxuriant sporting of nature. Trees are seen growing on a naked rock; their roots either penetrate some of its crevices, or run over its surface, and shoot into the ground. When a tree is contiguous to a small rock, its bark will frequently inclose and cover it. Branches of different trees, but of the same species, sometimes intertwine, and even ingraft themselves, so as to grow together in one. On some trees, are found large protuberant warts, capable of being formed into bowls, which are very tough and durable. On rocks, as well as on trees, we find varieties of moss; it sometimes assumes a grotesque appearance, hanging in tufts, like long hair, from the branches; or inclosing the trunks; or spreading over rocks, like a carpet, and extending from one rock to another. It is observed that moss is thickest on the north sides of trees. By this mark the savages know their course in cloudy weather, and many of our hunters have learned of them, to travel without a compass. (III: 56–57.)

Even more striking is the chapter devoted to the pine trees or "mast-trees," too long to be found here, but given in the appendix, in which

Belknap despite the awkwardness of its style reached an almost epic height in the description of the mighty battle waged by the lumbermen against the giant trees.

But for Belknap, as well as for Coxe, Rush and almost all his contemporaries, the main question remains "How to subdue the land and how it can be converted into mowing or pasture." (III: 95.)

This again reads in spots like an epic, but an epic of destruction. Girdling the trees, felling the trees, burning them the succeeding spring before the soil is too dry, collecting the ashes for the manufacturing and the exporting of pot and pearl ashes, a much more profitable employment than selling the wood, employing "every day's labor in subduing the wilderness," so as to lay "a foundation for future profit," such should be the prospects of "enterprizing young men" who, instead of remaining "upon the old lands would find it more profitable to go upon new." (III: 101.)

In fact, Providence itself seems to encourage man in this work of destruction or reclamation and with great reverence Belknap describes the efforts of the beavers building a dam "back of which there is often a tract of land of five hundred acres which being under water for half of year has no vegetation":

> It is now that the hunter, ferreting the innocent beaver, is also made subservient to the great design of Providence, which is by opening the dam and destroying the beaver, so that it is not repaired. Of consequence, the water is drained off, and the whole tract, which before was the bottom of a pond, is covered with grass which grows as high as a man's shoulders, and very thick. (III: 118.)

Typical of the general attitude of his contemporaries was the old geographer Jedidiah Morse, whose *American Universal Geography* stood for a long time as a classic. A compiler more than an original writer, he combined the points of view of the lovers of nature and the lovers of civilization and "republicanism" in his panorama of New England, but his preference for the more civilized aspects of the country is obvious:

> New England is a high, hilly, and in some parts a montanous country, formed by nature to be inhabited by a hardy race of free, independent republicans. The mountains are comparatively small, running nearly north and south in ridges parallel to each other. Between these ridges, flow the great rivers in majestic meanders, receiving the innumerable rivulets and larger streams which proceed from the mountains on each side. To a spectator on the top of a neighbouring mountain, the vales between the ridges, while in a state of nature, exhibit a romantic appearance. They seem an ocean of woods, swelled and depressed in its surface like that of the great ocean itself. A richer, though less romantic view is presented, when the vallies, by industrious husbandmen, have been cleared of their natural growth; and the fruit of their labour appears in loaded orchards, extensive meadows, covered with large herds of sheep and neat cattle, and rich fields of flax, corn, and the various kinds of grain (p. 337, 3rd ed., Boston, 1796).

Even if it be granted that isolated voices advocating forest conservation were faintly heard, at the end of the eighteenth century, conservation was not a commonly preached and accepted doctrine and the mass of the nation had to be educated as the European nations had been, not

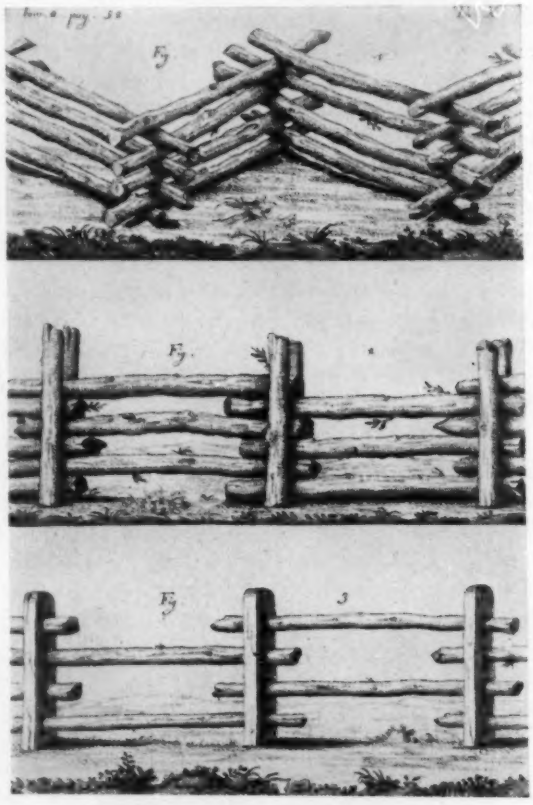


FIG. 6. Illustrating three types of fences: the first one according to the author requiring more wood and less labor than the others and found where wood is abundant; the second one "of a better construction"; the third found chiefly in Massachusetts, requiring a minimum of wood and alternating with the stone walls. From Luigi Castiglioni's *Viaggio negli Stati Uniti dell' America*, 2 v., Milano, 1790.

through preaching but through dire experience. Some Philadelphians were aware of their responsibility to future generations. As early as March 26, 1787, the Philadelphia Society for promoting Agriculture had called attention to the frightful waste of timber going on in Pennsylvania in non equivocal terms:

> A scarcity of timber sensibly affects the husbandmen in many parts of the country; and is an evil which increases rapidly. They may ask themselves, how they are to inclose and divide their fields, when, in a few years more, timber shall be exhausted. Inclination to plant and raise trees from seeds, is not enough felt; and yet planting is the most important measure to be observed for restoring timber to our farms, for all purposes. This business is avoided by some people, from an assurance that they cannot live to see the plantation grown up into timber; or if it might be expected, yet, "there is enough to last their time. Let those plant who come after them." (*American Museum* **6**: 351–353, Nov. 1789.)

In the same article, the anonymous writer had advocated the use of hedges and ditches as substitutes for the wasteful worm fence, in general use in Pennsylvania, and instead of "going to the woods, falling, cutting off, mauling, carting and putting up."

The same society had proposed on March 9, 1770, a prize for "the best method, deduced from experience, of raising the American white-thorn, from the seed." But just a few months before the same *American Museum* had printed a letter written by Benjamin Franklin which summed up much better the attitude prevailing in Pennsylvania:

> The vast quantity of forest lands we have yet to clear and put in order for cultivation, will, for a long time, keep the body of our nation laborious and frugal, . . . The world is large, and a great part of it is still uncultivated. Many hundred millions of acres in Asia, Africa, and America, are still forest and a great deal even in Europe. On a hundred acres of this forest a man might become a substantial farmer; and 100,000 men employed in clearing each his hundred acres, would hardly brighten a spot big enough to be visible from the moon, unless with Herschell's telescope; so vast are the regions still in woods. (*American Museum* **7**: 21, Jan. 1790.)

V. THE AMERICAN FOREST AS SEEN BY FOREIGN TRAVELERS. A FRENCH ADVOCATE OF CONSERVATION

It would take a long and elaborate study to pass in review the many descriptions written by foreign travelers. It would be seen that although most of them were not irresponsive to the beauty of the forests, they were in general far more interested in the progress of civilization and in the struggle against the all pervading vegetation waged by the American settlers than in conservation. Coming from lands where every effort was made to utilize and to save every scrap of wood and where the dearth of timber threatened the very existence of their countries, they saw in America a practically continuous forest with only a few clearings in which, in a sort of miraculous way the pioneers, after managing to eke out a precarious living, had introduced and were enjoying the amenities of civilization. Even such a "romantic" traveler as Chateaubriand, during his journey from Albany to Niagara, was amazed to find in the wilderness comfortable cottages, on whose porches rested nonchalantly, in the evening, delightful "misses," clad in light colored dresses, singing old world ballads and playing the harpsichord. In fact, it would be exceedingly dangerous and probably impossible to ascribe to any one traveler a definite attitude on the subject. The vital space in America was so huge as to defy man's power to compass it at one glance: there was room for a limitless development of civilization and for a limitless wilderness, and these two elements could coexist without encroaching upon each other. It was possible to admire without any reservation man's achievements in the conquest of the forest and progress of civilization, and nature as it had come from the hands of the Creator. It was possible to visit at Mount Vernon and at Monticello model establishments, splendidly appointed mansions, model farms, thriving orchards in which grew the best varieties of fruit trees imported from the Old World and to come up abruptly against the green wall of the primeval forest. Many of them, and particularly the British travelers, were quite indignant when along the roads they traveled they found the landscape marred by the stark outlines of rows of girdled trees, half rotten stumps and fallen timber, but they deplored the carelessness and untidiness of the pioneers and not the destruction of the forest.

In the appendix will be found several passages illustrating these different points of view: they are just samples of an abundant literature which would fill several shelves in the library of the student of the American scene. But none of them could be counted as an apostle of forest conservation. In fact some of them experienced a sort of sacred awe when they entered the wilderness. A few generations later, Thoreau will exclaim

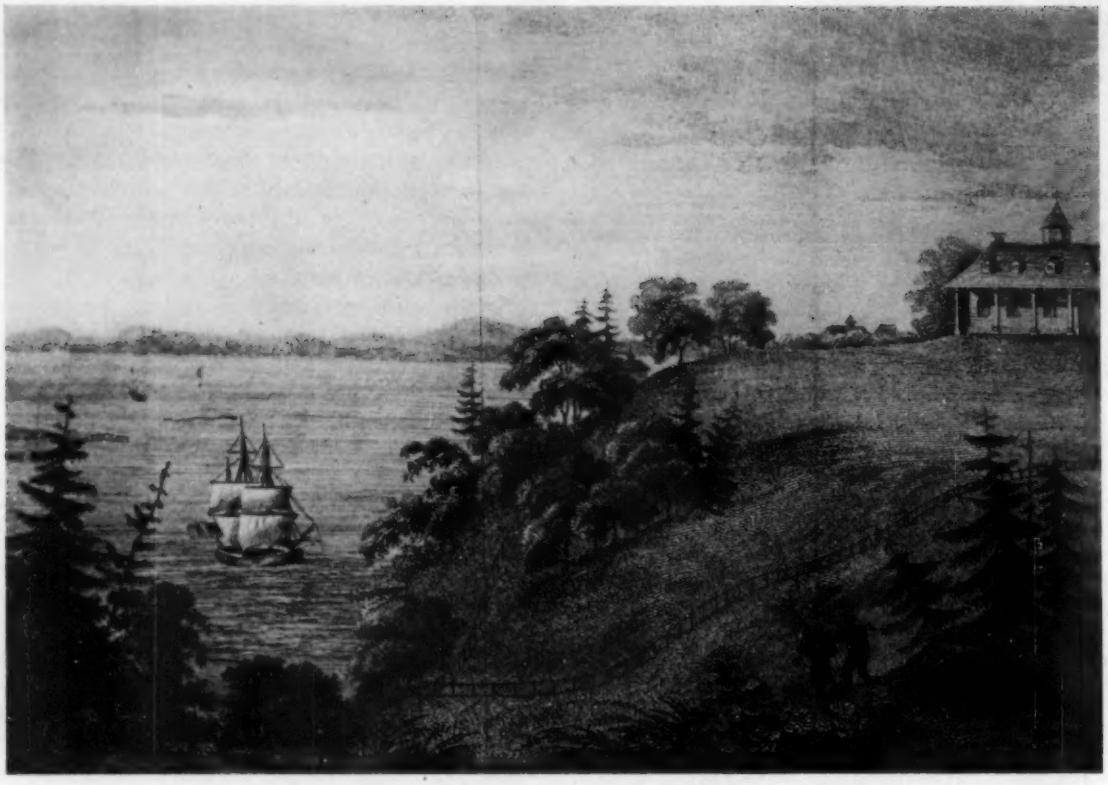


FIG. 7. Mount Vernon, the Seat of General Washington. "The ground in the rear of the house is also laid out in a lawn, and the declivity of the Mount, toward the water, in a deer park." Weld's *Travels* I: 92. A few clumps of ornamental trees have been preserved, and the most economical form of fence encloses the lawn.

after plunging into what he fondly believed was a primeval forest: "Here this vast, savage, howling mother of ours, Nature, lying all around, with such beauty, and such affection for her children as the leopard!" No such frantic outbursts could be found in the old European travelers in America. Chastellux, La Rochefoucauld-Liancourt, Isaac Weld, Volney and even Chateaubriand, to mention only a few, were too fond of human society to share such an extravagant feeling. Here, I shall quote only from two, who, although not well known, seem particularly significant.

The first one was the anonymous author of a versified *Voyage en Amérique. Dialogue en vers entre l'Auteur et l'Abbé* . . . A Londres (1786) et Paris, in-12,156 pages. The writer who had traveled in America and probably had come with Rochambeau had an opportunity to compare Rousseau's descriptions of "l'homme de la nature," with the American savages. As a result, he had lost all his illusions on the supposed happiness of the children of nature:

Quoiqu'en dise Rousseau que j'aime et que j'honore,
Si l'homme en nos cités n'est pas exempt de maux,
Le Sauvage est cent fois plus misérable encore:
Et vices & malheurs, il a tous les fléaux . . .

To the idyllic descriptions of the world such as it was when "it came from the hands of the Creator," the author opposed his own recollections, probably gathered in the Dismal Swamp during the Virginia campaign:

Sur les troncs dépouillés croit un peuple fétide
De mousse, d'agarics, de fongus rebutans,
Parasites des morts, vampires végétans;
Et ces bois redoutés n'offrent dans leur ténèbres
Que l'horreur du cahos & ses œuvres funèbres . . .
Tandis qu'un long essaim d'insectes venimeux,
De reptiles impurs les sifflemens affreux
Et tout l'air infecté d'une vapeur immonde
Tourmentant l'odorat et l'oreille et les yeux,
Répandent à l'entour une terreur profonde

At the other extreme, but summing up more common attitudes of mind, we may place a practi-

cally unknown English author, who having been for some years extensively engaged in American trade, with purely commercial views, published his *Letters from North America* in two volumes, London 1824. Adam Hodgson who apparently was as much interested in world history as in trade, had seen unfolded before his eyes a panorama illustrating the march of Western civilization rather than a purely American scene:

> The sudden creation of prosperous towns and highly cultivated farms, in whose solitudes, within a very few years, the Indian hunter pursued his game, appears rather like enchantment than the slow result of those progressive efforts, with which, in the old world nature has been subdued. Even in the *wilder* parts of England, we have to travel back many centuries before fancy can venture to draw even a few faint sketches of nature in her primitive dress; to pourtray, even in dim and distant vision, her native woods, her untrodden marshes, or the wild tenants of her primeval forests. (I: 340.)

Even more striking was his conclusion:

> . . . I have conversed with the polished circles of the Atlantic cities; the forlorn emigrant in the wilderness; the Negro on the plantation; and the Indian in his native forest. In successive intervals of *space*, I have traced society through those various stages which, in most countries, are exhibited only in successive periods of *time*. I have seen the roving hunter acquiring the habits of the herdsman; the pastoral state merging into the agricultural, and the agricultural state into the manufacturing and commercial. (II: 517.)

Soldiers, philosophers, traders, poets, philanthropists, gentlemen farmers, engineers, all the professions and the most various interests are represented in these early visitors of America. Among them however, only two were botanists of distinction and more especially dendrologists or foresters and both of them happened to be closely connected with the American Philosophical Society. Above all their contemporaries they stand by themselves, both as specialists and men of vision. Both of them, André Michaux, the father, and François André Michaux, the son, substantially contributed to the cause of forest conservation in America as well as in their native country.

André Michaux, the father, had come to America with a very definite mission from Louis XVI. Even a superficial survey of contemporary documents shows that at the end of the eighteenth century the dearth of wood had become acute in France and caused real distress. The forests had been ruthlessly and indiscriminately cut down in order to provide fuel, a vital need during a succession of very severe winters; but above all it had plainly appeared that France would not become again a great naval power unless she found some way to procure the timber necessary for the building of a fleet. In normal times some of that essential raw material could be imported; but the country was in danger of being cut off from the source of supply in time of war. France had to grow her own timber on her own soil.

Since we hope to publish within a short time as complete a study as can be made of André Michaux's mission from the abundant material preserved in the collections of the American Philosophical Society, we shall simply recall that Michaux's chief objective was to make a survey of the American forest in order to find out what varieties of trees and more particularly of oaks could be grown successfully in France. It will be remembered that he established two nurseries, one in Bergen, New York, the other one in Charleston; that he was assisted on his Western trip, undertaken for scientific and political purposes, by the American Philosophical Society. He died before the publication of his capital work, his *Histoire des chênes d'Amérique*, printed in Paris in 1801, and at once translated into English and printed in Dublin by Walter Wade.

His work was taken up by his son François-André who had accompanied his father on his ramblings through the American woods from 1787 to 1792, and revisited America on two occasions at the beginning of the nineteenth century. After publishing his *Voyage à l'ouest des monts Alleghanys*, in 1804, full of botanical notes and considerations on forestry, he gave in 1817 his monumental *North American Sylva*, published in Paris, and distributed in America through the care of John Vaughan. For half a century, it stood as the most authoritative work on the American forest and was reprinted in 1841, again in 1857, and finally in 1865.

It is not only a systematic survey and a botanical study of the American trees, but a practical repertory, since the author had considered the trees "particularly with respect to their use in the Arts and their Introduction into Commerce." Michaux cared little for abstract reasoning and theorizing, but he saw and knew the trees and he had very definite ideas about the way the American forest should be both preserved and exploited.

With him he brought to America the experience

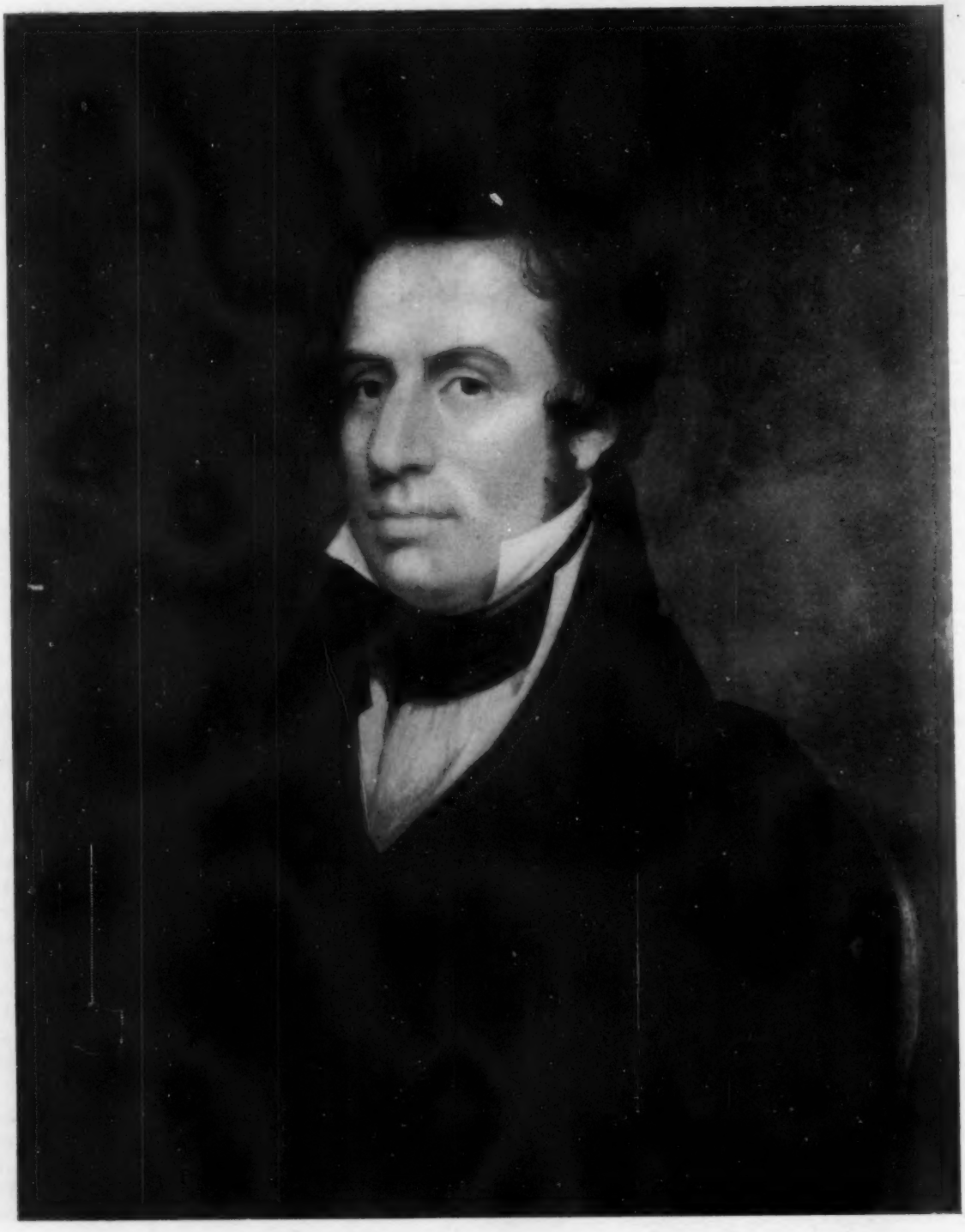


FIG. 8. François-André Michaux. From the portrait by Rembrandt Peale in the Hall of the American Philosophical Society.

of a European and more especially of a Frenchman. The Revolution, and the parcelling off of the royal forests and domanial property of the "seigneurs," had marked the beginning of an unprecedented destruction of the French forest already depleted during the preceding period. The ordinance of 1689 had been entirely disregarded, agriculture had made considerable progress; but, in the hands of private owners, eager to clear more land for more cultivation and to sell whatever timber stood on their land, the woods faced complete annihilation. Appeals to the public were of no avail: this was clearly a matter of national interest and the government had to step in to revive and strengthen the old regulations.

Apparently America was confronted with no such problem and the resources of the American forest seemed inexhaustible. In fact, at that time, it was thought that the main problem was a problem of transportation rather than a problem of supply. Not so in the eyes of Michaux, who constantly kept in mind the harsh lesson the French had to learn. Between the two trips he took at the beginning of the century, between 1802 and 1807, in the short space of five years, he could verify that the destruction of the American forest had proceeded at a terrifying pace. A friend of America, a traveler who had received everywhere the most generous hospitality, remembering also how his father had been assisted in his work by the Philosophical Society of Philadelphia, François-André Michaux deemed that he had contracted a debt of gratitude towards the American people and he undertook to repay in two different ways. First, by the publication of the *North American Sylva,* containing an inventory of the riches of the American forest, and in advocating definite measures for the preservation of the trees. Considered from this point of view, the *Introduction* he wrote for the *Sylva* remains one of the most important landmarks in the history of forest conservation in America. One passage at least must be quoted here:

> The pursuit of my principal object necessarily led to an intimate knowledge of the American trees and to carefull examination of such are most interesting and useful in the different kinds of construction, in the arts, and for the purpose of fuel. I have also endeavoured to impress on the American farmers the importance and pecuniary advantages which would result to them and to their families from the preservation of different species of timber of which they ought to ensure the growth, and on the contrary I have noted those which ought to be destroyed; for I am of opinion that a bad tree ought not to be suffered to exist where a better could grow; and there is no country where it is more important to make a choice than in America.
>
> This is the proper place to make a general remark relative to the management of woods. It cannot be denied that, in the present state of things the Europeans have, in that respect, every advantage over the Americans. In Europe the principal forests are in the hands of the different governments, who watch over their preservation with all the sollicitude which imperious necessity requires. Experience had amply demonstrated that no dependence can be placed for public service, or the wants of the people upon forests which are private property: falling sooner or later into the hands of persons eager to enjoy, they gradually diminish and ultimately disappear, and the ground upon which they stood is appropriated to annual cultivation. In America, on the contrary, neither the federal government, nor the governments of the different States, to my knowledge, reserved to themselves any portion of forests. An alarming destruction of the trees proper for civil or naval construction has been the consequence, a destruction which goes on increasing, and which will continue to increase in proportion to the increase of population. The effect is already felt in a very lively manner in the great cities, where they complain more and more every year, not only of the excessive dearness of fire wood, but even of the difficulty of procuring timber for the various kinds of building and public works.

Michaux did not believe that his debt had been sufficiently repaid by the publication of the *North American Sylva.* He was fully aware that little heed had been paid to his earnest plea for conservation. It was not in his power to stem the tide and to stop the American foresters in their ruthless destruction, but at least he could encourage his Philadelphia friends and associates to start on a small scale a conservation movement. In his letters to the Secretaries of the American Philosophical Society, he had on several occasions manifested his intention to leave at his death a substantial sum of money to further such a work of education, and he had sent them copies of the wills he had made from the year 1852 on. When notice of his death arrived in Philadelphia, the sealed envelopes were opened in the presence of the French Consul and the contents duly registered. It does not seem that the documents have ever been published in full: here I shall simply give a translation of the part of Michaux's last will which concerns more particularly the Society and annuls all previous dispositions:

September 4, 1855

Wishing to acknowledge the services, welcome and cordial hospitality that my father and myself, jointly or individually, have received during our long and often dangerous journeys through the whole territory of the United States, as a token of my vivid gratitude and in order also to contribute in one country, namely the United States, to the extension and progress of agriculture and more especially of sylviculture, I give and bequeath to the American Philosophical Society of Philadelphia, of which I have the honor to be a member, the sum of $12,000, fr. 5.40 to the dollar . . . 648,000. I give and bequeath to the Society of Arts and Agriculture of the state of Massachusetts, Boston, of which I have the honor to be a member, the sum of $8,000, fr. 5.40 to the dollar, or 43,200; altogether amounting to 108,000, or $20,000.

I hereby declare that all wills, codicils, and any other testamentary depositions written before the fourth of September of this year, 1855, if not abrogated in toto or in part hereby, will be considered as null and non-existing, and so are and will be disinherited any kin born, or to be born, who would share in my succession, if I had not given the present depositions.

André François Michaux

At the time, the Philosophical Society could only register the will, since the legacy was to be turned over to the Society only after the death of Michaux's widow. When she died, owing to the low rate of exchange, the original sum had shrunk to six thousand dollars. Even before, however, on March 18, 1870, the Society had already proposed that:

The name of André François Michaux who travelled long in this country, and described our Oaks and forest trees, in a work of great merit and splendor, should have his name, and that of his father (who had, by like travel and study, rendered service to science), honored in the Fairmount Park, in a manner to be a memorial to their devotions, and to promote the objects which had occupied their lives, and has proposed after the death of the widow of André François Michaux, to devote the interest or income of six thousand dollars bequeathed by him to said Society, to be expended in execution of the trust of his will in the said Park, for the purpose following. Therefore,

Resolved, That there shall be a grove of Oaks in the Fairmount Park forever to bear the name of "Michaux Grove" in which, if practicable, shall grow two oaks of every kind that will endure the climate. . . .

This was only a beginning. On May 4, 1877, it was decided that two hundred dollars be appropriated for the expenses of a course of lectures contributing to the extension and progress of sylviculture to be delivered by Dr. J. T. Rothrock of the University of Pennsylvania.

The lectures a syllabus of which has been preserved were delivered quite appropriately in Horticultural Hall in Fairmount Park and mark the beginning of a new era in the history of forest conservation. From 1877 to 1894, the income from the Michaux fund was devoted to this most needed work of education and to the propagation and planting of trees in the Park. In 1889, Dr. Rothrock had slides and enlargements made from them to be exhibited at the Paris Exposition, as an illustration of the work undertaken under the auspices of the Society. By that time, however, the results already attained had grown out of proportion with the sums expended. In the address delivered in 1893 before the Society, Dr. Rothrock could trace with legitimate pride the history of the movement and recall that in 1885, the Senate and the House had concurred in requesting that one day each year be appointed as "Arbor Day." The following year was founded the Pennsylvania Forestry Association.

The seedling planted by André Michaux had become a mighty tree and was beginning to bear fruit. The era of destruction had been succeeded by the era of conservation and cultivation of trees, called for at the close of the eighteenth century by Tench Coxe, who had expressed at the time a pious but ineffective wish. America at last had come of age; the ruthless pioneers were only a memory; the country had developed a civilization of its own and more than caught up with Europe, and nature almost completely subdued was no longer an enemy standing in the way of social progress. Once more had been verified the assertion of the British traveler that American civilization to a large extent reproduced in space and with a sort of explosive suddenness the age long work of European generations.

BIBLIOGRAPHICAL NOTE

The literature of the forest is so extensive that no attempt to establish an adequate bibliography can be made here. For the European background of the subject the following works will prove useful: John Croumbie Brown, *The Forests of England and the Management of them in bygone times*, Edinburgh, 1883; and *French Forest Ordinance of 1669, with an Historical Sketch of previous treatment of forests in France*, Edin-

burgh, 1883.—Robert Greenhalgh Albion, *Forests and sea power. The timber problem of the Royal Navy, 1652–1862,* Harvard University Press, 1926; and Frederic Chapin Lane, *Venitian Ships and Shipbuilders of the Renaissance,* Johns Hopkins Press, 1934.

The same problem presented from the American point of view has been studied by Robert G. Albion, *The Rise of New York Port (1815–1860)*, Scribner's, 1939. The bibliography is very extensive and covers many aspects of the subject. Professor Albion refers to a manuscript Harvard dissertation "prepared for publication" of a much larger scope: J. G. B. Hutchins, *The Rise and Fall of the Building of Wooden Ships in America, 1607–1914,* 2 v. ms., 1936.

As far as I know, no attempt has been made to study separately the American forest as a factor of civilization. The whole historical development of the colonies and the United States could be studied from that special point of view, since the present "age of steel" or metallurgic era was preceded by the "age of wood." The economic aspect alone would deserve an elaborate treatment but no less important would be the social aspect. It would also be seen that literature proper exerted a powerful influence in developing a "feeling" for the trees and the forest and helped considerably in bringing about legislative measures of conservation. A very inadequate but interesting aspect of the literary problem will be found in Frank Leland Tolman, "Legends and Poetry of the Forests Introduction by John Finley," *University of the State of New York Bulletin* No. 564, April 1, 1914.

Good bibliographies of English travelers in America will be found in Jane Louise Mesick, *The English Travellers in America, 1785–1835,* Columbia University Press, 1922; and Allan Nevins, *American Social History as regarded by British Travellers,* London, George Allen and Unwin Ltd., 1923. For the French travelers, Frank Monaghan's bibliography, *French Travellers in the United States, 1765–1932,* New York Public Library, 1933, will prove useful. But no special treatment of the forest will be found in any of these books.

Equally disappointing from this point of view are the chapter of Lane Cooper on "Travellers and Observers, 1763–1846," in *The Cambridge History of American Literature,* Macmillan, 1917; and Vernon Louis Parrington, *The Colonial Mind, 1620–1800,* Harcourt Brace, 1927.

On the botanical aspect interesting and useful information will be found in "America—A hunting ground for eighteenth century naturalists with special reference to their publications about trees," by June Rainsford Butler, *Papers of the Bibliographical Society of America* **32**: 1–16, 1938.

No attempt has been made here to exhaust, nor even to outline the whole subject. A few passages from old travelers and memorialists, printed in an appendix, may simply serve to illustrate the variety, richness and interest of this neglected field. The material is so abundant that it could have been extended almost indefinitely, but, with two exceptions, it was selected from works written by members of the Society. If time and space had permitted, I should have liked to include at least one additional selection, taken from *Viaggio negli Stati Uniti dell' America Settentrionale fatto negli anni 1785, 1786 e 1787 da Luigi Castiglioni, Patrizio Milanese, Cavaliere dell' Ordine di S. Stefano P.M., Membro della Società Filosofica di Filadelfia, e della Patriotica di Milano. Con alcune Osservazioni sui Vegetabili più utili di quel Paese,* Milano, Giuseppe Morelli, 2 v. 1790. Castiglioni was closely connected with members of the Society during his stay in America; he attended many of its meetings, was well received in political and literary circles and became intimate with Franklin and Rush whose essay on population he translated almost in full in his account. His purpose was similar to Michaux's: he was particularly interested in trees and shrubs which could be acclimatized in Lombardy and his two volumes constitute an interesting and valuable testimony of the influence exerted abroad by America through the channel of the Philosophical Society.

Finally, it may be noted that the views of Chastellux, Crèvecœur, Rush, and La Rochefoucauld Liancourt were strikingly and forcefully summed up by Talleyrand in his "Mémoire sur les relations commerciales des Etats-Unis avec l'Angleterre," *Mémoires de l'Institut National des sciences et arts. Sciences morales et politiques,* II, Fructidor, and VII. A more detailed treatment of the life of the "lumberman," and the frontier will be found in *Talleyrand in America as a financial promotor, 1794–96. Unpublished letters and memoirs,* translated and edited by Hans Huth and Wilma J. Pugh, Volume II of the *Annual Report of the American Historical Association for the year 1941,* Government Printing Office, Washington, 1942.

APPENDIX

I

"THE IMMENSE BENEFIT OF AGRICULTURE"

MARQUIS DE CHASTELLUX. *Travels in North-America, in the years 1780–81–82, . . . with notes by the translator . . . and notes and additions by the American editor,* 33–35. New York, White, Gallagher, & White, 1827.

. . . I pursued my journey, which soon brought me amidst the steepest and most difficult mountains I had yet seen. They are covered with woods as old as creation, but which do not differ from ours. These hills heaped confusedly one upon another, oblige you to be continually mounting and descending, without your being able to distinguish in this wild region, the summit which rising above the rest, announces to you a conclusion to your labours. This disorder of nature reminded me of the lessons of him whom she has chosen for her confident and interpretor. The vision of M. de Buffon appeared to me in these ancient deserts. He seemed to be in his proper element, and to point out to me, under a slight crust formed by the destruction of vegetables, the inequality of a globe of glass, which has cooled after a long fusion. The waters said he, have done nothing here; look around you, you will find not a single calcareous stone; every thing is quartz, granite, or flint. I made experiments on the stones with aquafortis, and could not help concluding, what has not obtained sufficient credit in Europe, not only that he speaks well, but that he is always in the right.

While I was meditating on the great process of nature, which employs fifty thousand years in rendering the earth habitable, a new spectacle, well calculated as a contrast to those which I had been contemplating, fixed my attention, and excited my curiosity; this was the work of a single man, who in the space of a year had cut down several arpents of wood, and had built himself a house in the middle of a pretty extensive territory he had already cleared. I saw, for the first time, what I have since observed a hundred times; for in fact, whatever mountains I have climbed, whatever forests I have traversed, whatever bye-paths I have followed, I have never travelled three miles without meeting with a new settlement, either beginning to take form or already in cultivation. The following is the manner of proceeding in these improvements or new settlements. Any man who is able to procure a capital of five or six hundred livres of our money, or about twenty-five pounds sterling, and who has strength and inclination to work, may go into the woods and purchase a portion of one hundred and fifty or two hundred acres of land, which seldom costs him more than a dollar or four shillings and sixpence an acre, a small part of which only he pays in ready money. There he conducts a cow, some pigs, or a full sow, and two indifferent horses which do not cost him more than four guineas each. To these precautions he adds that of having a provision of flour and cider. Provided with this first capital, he begins by felling all the smaller trees, and some strong branches of the large ones; these he makes use of as fences to the first field he wishes to clear; he next boldly attacks those immense oaks, or pines, which one would take for the ancient lords of the territory he is usurping; he strips them of their bark, or lays them open all around with his axe. These trees mortally wounded, are the next spring robbed of their honours; their leaves no longer spring, their branches fall, and their trunk becomes a hideous skeleton. This trunk still seems to brave the efforts of the new colonist; but where there are the smallest chinks or crevices, it is surrounded by fire, and the flames consume what the iron was unable to destroy. But it is enough for the small trees to be felled, and the great ones to lose their sap. This object completed, the ground is cleared; the air and the sun begin to operate upon that earth which is wholly formed of rotten vegetables, and teems with the latent principles of production. The grass grows rapidly; there is pasturage for the cattle the very first year; after which they are left to increase, or fresh ones are brought, and they are employed in tilling a piece of ground which yields the enormous increase of twenty or thirty fold. The next year the same course is repeated; when, at the end of two years, the planter has where-withal to subsist, and even to send some articles to market; at the end of four or five years, he completes the payment of his land, and finds himself a comfortable planter. Then his dwelling, which at first was no better than a large hut formed by a square of the trunks of trees, placed one upon another, with the intervals filled by mud, changes into a handsome wooden house, where he contrives more convenient, and certainly much cleaner appartments than those in the greatest part of our small towns. This is the work of three weeks or a month. His first habitation, that of eight and forty hours. I shall be asked, perhaps, how one man or one family can be so quickly lodged; I answer, that in

America a man is never alone, never an isolated being. The neighbours, for they are everywhere to be found, make it a point of hospitality to aid the new farmer. A cask of cider drunk in common, and with gaiety, or a gallon of rum, are the only recompense for these services. Such are the means by which North-America, which one hundred years ago was nothing but a vast forest, is peopled with three millions of inhabitants; and such is the immense, and certain benefit of agriculture, that notwithstanding the war, it not only maintains itself where ever it has been established, but it extends to places which seem the least favourable to its introduction. Four years ago, one might have travelled ten miles in the woods I traversed, without seeing a single habitation.

II

EFFECT OF CLIMATE AND OTHER CAUSES ON THE HUMAN CONSTITUTION

JEREMY BELKNAP, D.D., Member of the American Philosophical Society held at Philadelphia for promoting useful knowledge, and of the Academy of Arts and Sciences in Massachusetts. *The History of New Hampshire* III: 171–173. 2nd ed. Boston, 1813.

It has been confidently asserted by European writers, and by some of great reputation, that the climates of America, under similar latitudes to those of Europe, are unfriendly to health and longevity; that the general period of human life is from forty-five to fifty; and these pernicious effects are ascribed to putrid exhalations from stagnant waters; to a surface uncleared, uncultivated, and loaded with rank vegetation, which prevents it from feeling the purifying influence of the sun.

If such remarks were intended to be confined to the low plains in the southern States, the propriety of them might not perhaps be disputed; but a distinction ought to be made between those parts of America and others in far different circumstances. If authors profess to write as philosophers they should seek for information from the purest sources, and not content themselves with theorising on subjects, which can be determined only by fact and observation; or with forming general conclusions from partial reports. If they write as politicians, their aim may indeed be answered by stating facts in a delusive light; and by representing America as a grave to Europeans, they may throw discouragement on emigration to this country. It is at the same time amusing to observe the inconsistent conclusions of these theorising philosophers; for whilst one condemns the air of woodland as destructive to life and health, another celebrates it as containing *nutritive* particles, and asserts that men who live in the woods consume less food than those who dwell in open countries. But notwithstanding the dreams of European philosophers, or the interested views of European politicians, America can best be described by those who have for a long time resided in it. Those who have not seen it at all, and those who have passed through it with the rapidity of a traveller, can be very inadequate judges; yet unhappily there are many of both these classes of writers whose accounts have gained more credit than they deserve.

In that part of America which it falls to my lot to describe, an "uncleared and uncultivated soil," is so far from being an object of dread, that there are no people more vigorous and robust than those who labour on new plantations; nor in fact have any people better appetites for food. This is true not only of the natives of the country, but of emigrants from Europe. It has been a general observation that the first planters in new townships live to a great age. It is also true that the air of our forest is remarkably pure. The tall and luxuriant growth not only indicates strength and fertility of soil; but conduces to absorb noxious vapours; and when the soil is once cleared, if man neglect his duty, nature, with her bountiful hand, produces a second growth of "rank vegetation," for the same benevolent purpose. A profusion of effluvia from the resinous trees imparts to the air a balsamic quality which is extremely favourable to health, and the numerous streams of limpid water, some of which fall with great rapidity from the mountains, cause currents of fresh air which is in the highest degree salubrious, to those who reside on their banks. To these observations it may be added, that the northwest wind is the grand corrector of every noxious quality which can exist in the air of America; and whilst that wind prevails, it diffuses health and imparts vigor to the human frame.

There are, indeed, some few situations, even in New-Hampshire, where vapour arising from land overflowed with fresh water, produces bilious and nervous diseases, and the inhabitants are subject to an early lassitude and debility; which is often increased by an injudicious use of spiritous liquors for medical purposes; but by the removal of such persons to the purer air of the mountains, and a change to a more temperate regimen, these com-

plaints cease, and the constitution is reinvigorated.

There have also been some instances in the neighbourhood of Connecticut river, of swellings in the throat similar to the *goitres* among the inhabitants of the Alps. Women have chiefly been affected in that way. A removal to the sea shore, and constant bathing with salt water have contributed to reduce these tumours. A free use of salted fish and vegetable acid, particularly cyder, has also been found beneficial, and by the best and latest information which I have been able to obtain, this disorder is now less frequent, and more easily controled than it was a few years past.

THE PRINCE OF THE AMERICAN FOREST

JEREMY BELKNAP. *The History of New Hampshire* III: 77–82. 2nd ed. Boston, 1813.

Pine. (*pinus*) Of this genius we have at least seven species. 1. The White Pinus (*pinus florbus*) is undoubtedly the prince of the American forest in size, age and majesty of appearance. More of this species have been produced in New-Hampshire, and the eastern counties of Massachusetts than in all America besides. These trees have a very thin sap, and are distinguished by the name of mast-pine from the succeeding growth of the same species, which are called saplings. The blossom of this and other pines appears about the middle of June, its *farina* is of a bright yellow, and so subtil that it is exhaled with vapor from the earth, ascends into the clouds and falls with rain, forming a yellow scum on the surface of the water, which the ignorant erroneously call sulphur from the similarity of its colour.

When a mast tree is to be felled, much preparation is necessary. So tall a stick without any limbs nearer the ground than eighty or a hundred feet, is in great danger of breaking in the fall. To prevent this, the workmen have a contrivance which they call *bedding* the tree, which is thus executed. They know in what direction the tree will fall; and they cut down a number of smaller trees which grow in that direction; or if there be none, they draw others to the spot, and place them so that the falling trees may lodge on their branches; which breaking or yielding under its pressure, render its fall easy and safe. A time of deep snow is the most favorable season, as the rocks are then covered, and a natural bed is formed to receive the tree. When fallen, it is examined, and if to appearance it be found, it is cut in the proportion of three feet in length to every inch of its diameter, for a mast; but if intended for a bow-sprit or a yard, it is cut shorter. If it be not found throughout, or if it break in falling, it is cut into logs for the saw mill.

When a mast is to be drawn, as its length will not admit of its passing in a crooked road a straight path is cut and cleared for it through the woods. If it be cut in the neighborhood of a large river, it is drawn to the bank and rolled into the water, or in the breaking up of the river in the spring. From other situations masts are now conveyed twenty, thirty or forty miles to the landing places at the head of the tide, and as the distance has increased, more safe and easy modes of conveyance have been invented. Formerly, if drawn on wheels, the mast was raised by levers, and hung by chains under the axle. In this case it was necessary to use very strong and heavy chains, and wheels of sixteen or eighteen feet in diameter, that the mast, in passing, might be cleared from the ground, which was often encumbered with rocks and stumps. Now, the common wheels and chains are used, and the largest stick, by a very easy operation, is raised on the axle. To perform this, the wheels being brought near to it, are conted; the axle being set in a perpendicular position, one wheel on the ground and the other aloft. The mast is then rolled over the rim and spokes of the lower wheel, and fastened to the axle; and when it is thus fixed, a chain, which is previously made fast to the opposite side of the upper wheel, is hooked to a yoke of oxen; who, by a jerk, bring down the upper and raise the lower wheel, and thus both are brought into their proper position, with the mast mounted on the axle. They use two pair of wheels, one at each end of the mast; by which means, it is not galled by friction on the ground; and the draught is rendered much easier for the cattle.

When a mast is to be drawn on the snow, one end is placed on a sled, shorter, but higher than the common sort, and rests on a strong block, which is laid across the middle of the sled. Formerly, the butt end was placed foremost, and fastened by chains to the bars of the sled, which was attended by this inconvenience; that in sidelong ground, the stick by its rolling would overset the sled, and the drivers had much difficulty either to prevent or remedy this disaster, by the help of levers and ropes. The invention of the swivel chain precludes this difficulty. One part of this chain is fastened to the tongue of the sled, and the other to the smallest end of the mast, by means of a circular groove cut in it; one of the

intermediate links is a swivel, which, by its easy turning, allows the stick to roll from side to side, without overturning the sled. In descending a long and steep hill, they have a contrivance to prevent the load from making too rapid a descent. Some of the cattle are placed behind it; a chain which is attached to their yokes is brought forward and fastened to the hinder end of the load, and the resistance which is made by these cattle, checks the descent. This operation is called *tailing*. The most dangerous circumstance, is the passing over the top of a sharp hill, by which means, the oxen which are nearest to the tongues are sometimes suspended, till the foremost cattle can draw the mast so far over the hill, as to give them opportunity to recover the ground. In this case the drivers are obliged to use much judgement and care, to keep the cattle from being killed. There is no other way to prevent this inconvenience than to level the roads.

The best white pine trees are sold for masts, bowsprits, and yards, for large ships. Those of an inferior size, partly unsound, crooked, or broken in falling, are either sawn into planks and boards, or formed into canoes, or cut into bolts for the use of coopers, or split and shaved into clapboards and shingles. Boards of this wood are much used for wainscoting and cabinet work; it is of smooth grain, and when free from knots, does no injury to the tools of the workmen; but the softness of its texture subjects it to shrink and swell with the weather. The sapling pine, though of the same species, is not so firm and smooth as the veteran pine of the forest, and is more sensibly affected by the weather.

The stumps and roots of the mast pine are very durable. It is a common saying, that "no man ever cut down a pine, and lived to see the stump rotten." After many years, when the roots have been loosened by the frost, they are, with much labor, cut and dug out of the ground, and being turned up edge way, are set for fences to fields; in which state they have been known to remain sound for half a century. A collection of these roots would make an impenetrable *abbatis*, which nothing but fire could easily destroy.

Before the revolution, all white pines (excepting those growing in any township granted before the twenty-first of September, 1722) were accounted the King's property, and heavy penalties were annexed to the cutting of them, without leave from the King's surveyor. Since that event, these trees, like all others, are the property of the landholder.

(2). The Yellow pine (*pinus pinea*) is harder and heavier than the white, but never grows to the same size; its planks and boards are used for the floors of houses and the decks of ships.

(3). The Pitch pine (*pinus taeda*) is the hardest and heaviest of all the pines; it is sometimes put to the same uses as the yellow pine; but at present the principal use of it is for fuel. When burnt in kilns, it makes the best kind of charcoal; its knots and roots being full of the terebinthine oil, afford a light surpassing candles; its soot is collected, and used for lamp black. The making of tar from it is now wholly disused. Formerly, when it was made, the method was this. A piece of clay ground was chosen; or if it could not conveniently be had, the earth was paved with stone or brick, in a circular form, about twelve or fifteen feet in diameter, raised in the middle, and a circular trench was drawn round it, a few inches in depth. The wood being cut and split, was set upright in a conical pile, and covered on every side with sods, a hole being left open at the top, where the pile was set on fire. The confined heat melted the resinous juices of the wood, which flowed out at the bottom into the circular trench, and was conducted by other gutters, to holes in the earth, in which were set barrels to receive it. Turpentine is collected from every species of the pine, by boxing the trees; that from the white pine is the purest; it sometimes distils from the tree in beautifully transparent drops.

III

A JOURNEY FROM PHILADELPHIA TO BALTIMORE

ISAAC WELD, Junior. *Travels through the States of North America, and the Provinces of Upper and Lower Canada, during the years 1795, 1796, and 1797* I: 32–41. 3rd ed. London, 1800.

The country about Philadelphia is well cultivated, and it abounds with neat country houses; but it has a bare appearance, being almost totally stripped of the trees, which have been cut down without mercy for firing, and to make way for the plough; neither are there any hedges, an idea prevailing that they impoverish the land wherever they are planted. The fences are all of the common post and rail, or of the angular kind. These last are made of rails about eight or nine feet long, roughly split out of trees, and placed horizontally above one another, as the bars of a gate; but each tier of rails, or gate as it were, instead of being on a straight line with the one next to it, is put in a different direction, so as to

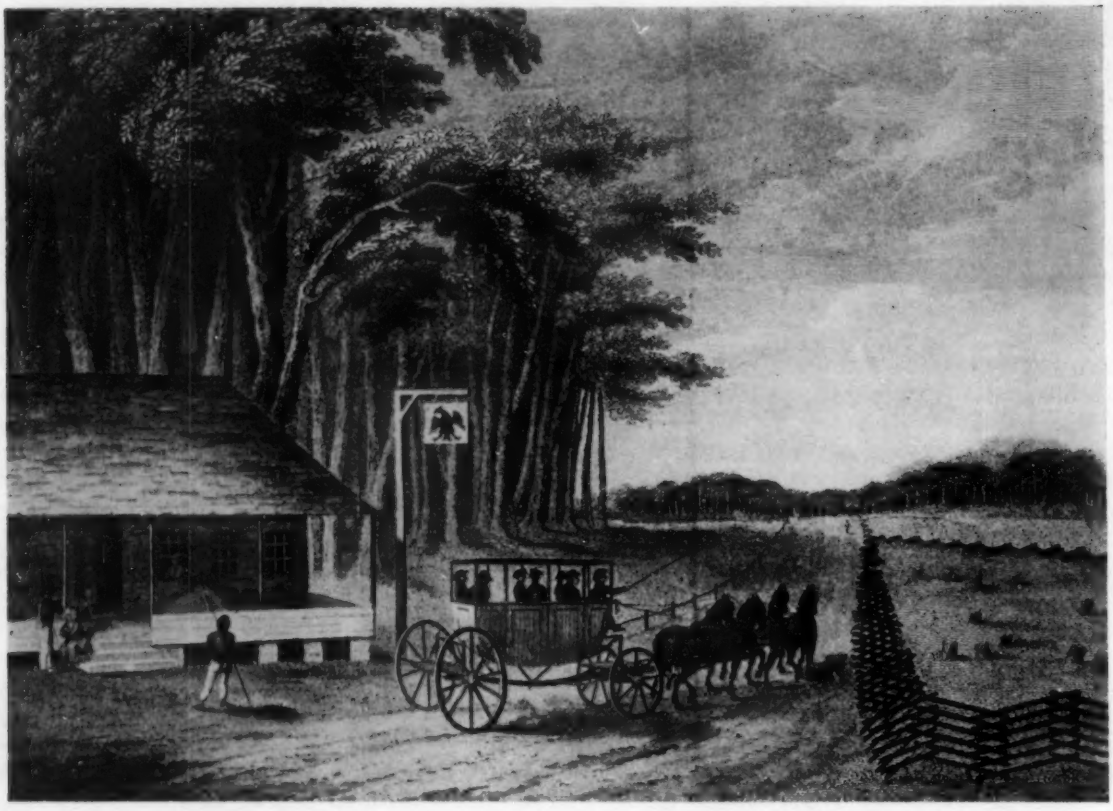


FIG. 9. American stage wagon. Aspect of the country near Philadelphia. "It has a bare appearance, being almost totally stripped of the trees. . . . The fences are all of the common post and rail or of the angular kind." From Weld's *Travels* I: 27. Note the contrast between the virgin forest and the desolated aspect of the clearings.

form an angle sufficient to permit the ends of the rail of one tier to rest steadily on those of the next. As these fences, from their serpentine course, occupy at least six times as much ground as a common post and rail fence, and require also a great deal more wood, they are mostly laid aside whenever land and timber become objects of importance, as they soon do in the neighbourhood of large towns. . . .

Charleston stands at a few miles distance from Elkton; there are about twenty houses only in it, which are inhabited chiefly by people who carry on a herring fishery. Beyond it the country is much diversified with hill and dale, and the soil being but of an indifferent quality, the lands are so little cleared, that in many parts the road winds through uninterrupted woods for four or five miles together. The scenery in this neighbourhood is extremely interesting. From the top of the hills you meet with the numberless bold and extensive prospects of the Chesapeak Bay and of the river Susquehannah; and scarcely do you cross a valley without beholding in the depths of the wood the waters of some little creek or rivulet rushing over ledges of rock in a beautiful cascade. The generality of Americans stares with astonishment at a person who can feel any delight at passing through such a country as this. To them the sight of a wheat field or a cabbage garden would convey pleasure far greater than that of the most romantic woodland views. They have an unconquerable aversion to trees; and whenever a settlement is made, they cut away all before them without mercy; not one is spared; all share the same fate, and are involved in the same general havoc. It appears strange, that in a country where the rays of the sun act with such prodigious power, some few trees near the habitations should not be spared, whose foliage might afford a cooling shade during the parching heats of summer; and I have oftentimes expressed my astonishment that none were ever left for that purpose. In

answer I have generally been told, that they could not be left standing near a house without danger. The trees it seems in the American forests have but a very slender hold in the ground, considering their immense height, so that when two or three fully grown are deprived of shelter in consequence of the others which stood around them being cut down, they are very apt to be levelled by the first storm that chances to blow. This, however, would not be the case with trees of a small growth which might safely be spared, and which would soon afford an agreeable shade if the Americans thought proper to leave them standing: but the fact of the matter is, that from the face of the country being entirely overspread with trees, the eyes of the people become satiated with the sight of them. The ground cannot be tilled, nor can the inhabitants support themselves, till they are removed, they are looked upon as a nuisance, and the man that can cut down the largest number, and have the fields about his house most clear of them, is looked upon as the most industrious citizen, and one that is making the greatest improvements * in the country.

THE AMERICAN LANDSCAPE

Isaac Weld, Junior. *Travels* . . . I: 231–233. 3rd ed. London, 1800.

The whole of this country, to the west of the mountains, is increasing most rapidly in population. In the neighbourhood of Winchester it is so thickly settled, and consequently so much cleared, that wood is now beginning to be thought valuable; the farmers are obliged frequently to send ten or fifteen miles even for their fence rails. It is only, however, in this particular neighbourhood that the country is so much improved; in other places there are immense tracts of woodlands still remaining, and in general the hills are all left uncleared. The hills being thus left covered with trees is a circumstance which adds much to the beauty of the country, and intermixed with extensive fields clothed with the richest verdure, and watered by the numerous branches of the Shenandoah River, a variety of pleasing landscapes are presented to the eye in almost every part of the route from Bottetourt to the Patowmac, many of which are considerably heightened by the appearance of the Blue Mountains in the back ground.

With regard to the landscapes however, and to American landscapes in general, it is to be observed, that their beauty is much impaired by the unpicturesque appearance of the angular fences, and of the stiff wooden houses, which have at a little distance a heavy, dull, and gloomy aspect. The stumps of the trees also, on land newly cleared, are most disagreeable objects, wherewith the eye is continually assailed. When trees are felled in America, they are never cut down close to the ground, but the trunks are left standing two or three feet high; for it is found that a woodman can cut down many more in a day, standing with a gentle inclination of the body, than if he were to stoop so as to apply his axe to the bottom of the tree; it does not make any difference either to the farmer, whether the stump is left two or three feet high, or whether it is cut down level with the ground, as in each case it would equally be a hindrance to the plough. These stumps usually decay in the course of seven or eight years; sometimes however sooner, sometimes later, according to the quality of the timber. They never throw up suckers, as stumps of trees would do in England if left in that manner.

The cultivated lands in this country are mostly parcelled out in small portions; there are no persons here, as on the other side of the mountains, possessing large farms; nor are there any eminently distinguished by their education or knowledge from the rest of their fellow citizens. Poverty also is as much unknown in this country as great wealth. Each man owns the house he lives in and the land which he cultivates, and every one appears to be in a happy state of mediocrity, and unambitious of a more elevated situation than what he himself enjoys.

A FOREST FIRE

Isaac Weld, Junior. *Travels* . . . I: 159–162. 3rd ed. London, 1800.

As I passed through this part of the country, I observed many traces of fires in the woods, which are frequent, it seems, in the spring of the year. They usually proceed from the negligence of people who are burning brushwood to clear the lands; and considering how often they happen, it is wonderful that they are not attended with more serious consequences than commonly follow. I was a witness myself to one of these fires, that

* I have heard of Americans landing on barren parts of the northwest coast of Ireland, and evincing the greatest surprise and pleasure at the beauty and improved state of the country, "so clear of trees!!"

happened in the Northern Neck. The day had been remarkably serene, and appearing favourable for the purpose, large quantities of brushwood had been fired at different places; in the afternoon, however, it became sultry, and streams of hot air were perceptible, now and then, the usual tokens of a gust. About five o'clock, the horizon towards the north became dark, and a terrible whirlwind arose. I was standing with some gentlemen on an eminence at the time, and perceived it gradually advancing. It carried with it a cloud of dust, dried leaves, and pieces of rotten wood, and in many places, as it came along it levelled the fence rails, and unroofed the sheds for the cattle. We made every endeavour, but in vain, to get to a place of shelter; in the course of two minutes the whirlwind overtook us; the shock was violent; it was hardly possible to stand, and difficult to breathe; the whirlwind passed over in about three minutes, but a storm accompanied by heavy thunder and lightning, succeeded, which lasted for more than half an hour. On looking round immediately after the whirlwind had passed, a prodigious column of fire now appeared in a part of the wood where some brushwood had been burning; in many places the flames rose considerably above the summit of the trees, which were of a large growth. It was a tremendous, and at the same time sublime sight. The negroes on the surrounding plantations were all assembled with their hoes, and watches were stationed at every corner to give the alarm if the fire appeared elsewhere, lest the conflagration should become general. To one plantation a spark was carried by the wind more than half a mile; happily, however, a torrent of rain in a short time afterwards came pouring down, and enabled the people to extinguish the flames in every quarter.

When these fires do not receive a timely check, they sometimes increase to a most alarming height; and if the grass and dead leaves happen to be very dry, and the wind brisk, proceed with so great velocity that the swiftest runners are often overtaken in endeavouring to escape from the flames. Indeed I have met with people, on whose veracity the greatest dependance might be placed, that have assured me they have found it a difficult task, at times, to get out of the reach of them, though mounted on good horses.

There is but one mode of stopping a fire of this kind, which makes such a rapid progress along the ground. A number of other fires are kindled at some distance a-head of that which they wish to extinguish, so as to form a line across the course, which, from the direction of the wind, it is likely to take. These are carefully watched by a sufficient number of men furnished with hoes and rakes, and they are prevented from spreading, except on that side which is towards the large fire, a matter easily accomplished when attended to in the beginnning. Thus the fires in a few minutes meet, and of consequence they must cease, as there is nothing left to feed them, the grass and leaves being burnt on all sides. In general there is but very little brushwood in the woods of America, so that these fires chiefly run along the ground; the trees, however, are often scorched, but it is very rare for any of them to be entirely consumed.

IV

"REFLECTIONS UPON THE BEST MODES OF BRINGING THE FOREST LANDS OF THE UNITED STATES INTO CULTIVATION AND USE"

TENCH, COXE. *View of the United States of America in a series of papers written . . . 1789–1794*, 450–457. Philadelphia, Hall, 1794.

There remain at this time, in most of the American states, extensive tracts of land, covered with forests, applicable to every purpose of human life, for which wood and timber are required. No country, so well accommodated with navigation and adapted to commerce and manufactures, possesses as great a treasure of the same kind. The manufactures, which can be made immediately of wood, are no less numerous than important. Ships, boats, masts and spars, oars, hand-spikes, anchor-stocks, casks and other coopers ware of every size and kind, cabinet wares, and other household furniture, farming and mechanical implements and tools, staves, headings, hoops, boards, plank, scantling, joists, square timber, shingles, frames of houses, turners wares, carriages for pleasure and for draught, corn-fans, wheel barrows, measures, scale plates, timber for machinery and mills, canon carriages, gun-stocks and other military implements for the sea and land services are among the objects contemplated.

The manufactures, to which wood is necessary in the form of fuel, are also numerous and important. Glass-houses, potteries, distilleries, brick-kilns, furnaces, forges, mills for rolling and slitting iron and other metals, refineries of sugar, black-smiths and all other smith shops are among the principal instances.

The manufactures to produce which, wood is requisite for the making of ashes, are the great articles of soft and hard soap, which are of uni-

versal consumption and the very important articles of pot-ash and pearl-ash.

To all these may be added the manufactory of tanned leather, which demands the bark of various and innumerable trees.

Of the wooden raw materials and fuel for these invaluable and numerous manufactures, the United States possess, if we may so speak, *an immense and unequalled magazine*. They appear therefore to be invited to establish *manufactures in wood* by the most weighty and obvious considerations.

But when it is remembered, that this immense magazine of wooden materials and fuel will obstruct, for a time, the cultivation of millions of acres of the best lands, we must feel another and a more powerful impulse to the active promotion of manufactres in wood. To enforce these general ideas the following application of them in the manufacturory of pot-ashes is here offered:

A method of clearing a farm lot of new woodland, easily practicable by persons having no more money or provisions than are sufficient to provide the food and clothing of their families, during the first year of their settlement.

1st. The settler in making this clearing must take care to burn the brush and wood, in such manner as to preserve the ashes. Out of the good ashes, thus saved, he should dispose of this for ready money, strong clothing, axes, spades, ploughs, or such other things for his farm, or family, as it would otherwise be necessary for him to procure, by selling or bartering, grain or cattle, if he had them to spare. It is believed, that the pot ash or pearl ash will procure him as much value as all the expenses and labor of the clearing, during the season would be worth in cash. He will therefore obtain as much money or goods as will enable him to hire assistance, in the next season, either to farm, or to clear land, or to make his improvements, so as to save his own time, or labor entirely, for clearing more land, or to help him in doing it. He must again make pot ash or pearl ash, and he must again apply the money or goods, it sells for, to the clearing of the next season.— In this way, it is plain, that he will derive money enough from the clearing and pot ashes, of every year, to do much of the same in the year following. A man who has 40, 50 or 100 dollars to spare, at the out-set, will get his land cleared, in this manner very fast indeed. If he has sugar maple-trees on his land, he may also obtain money by making sugar in February and March, and selling or bartering it for cash, or goods to be laid out in like manner, in hiring hands the next season. If money is scarce in a new settlement, and he barters pot-ash or maple sugar, for strong trowsers, shirts, hats or jackets, he will find it easy to procure laborers for such necessaries. It is proper to observe, that if a man burns his wood and brush on every part of his newly cleared field, it is doubtful whether he does not injure the soil, by burning the half rotten leaves and light mould, or earth, which have been made from the rotten leaves of many years.— There is an opinion, that the ashes left from burning the trees greatly enrich the land, and that would be certain, if the light mouldy earth and half rotten leaves were not also consumed by the fire. The soil of all new countries appears to have for its upper part, a layer or stratum of half rotten vegetable materials, which are capable of being burned, but which it would be a great benefit to plough into the earth. Potatoes, the best food for new settlements, grow abundantly in that rotten vegetable soil. This is very well known.

It appears doubtful, whether the farmers in the long cleared counties of New-England, New-York, and New-Jersey, do not injure themselves very much by making pot-ash and pearl-ash, *considering how necessary the wood ashes are to manure* their farms, many of which are impoverished, and many naturally light. To carry the fodder and litter from a farm to other places does not appear more improper. But that is allowed to be very bad farming.

2dly. The above method of clearing lands, is obviously important to people of large property, who are desirous of improving their estates and their country, by clearing their lands expeditiously. They may effect it in two ways; either— 1st. by setting up pot ash works, at their mills or country stores, or other central places, and buying wood ashes of the settlers of new fertile lands, and making them into pearl ashes, or pot ashes, and then selling them for exportation; or 2dly. by employing wood-cutters and other laborers, to fell the trees, and oxen or horses, with chains to bring the wood together for burning, then collecting the heaps of ashes and making pearl ashes, which is a simple and easy operation. It is said to be a fact, and it is highly worthy of notice that the expence of clearing an acre of land is fully and completely reimbursed, by the nett sales of the pot ashes or pearl ashes, collected after thus burning the trees—Hence it would follow that if a person of substance should purchase one thousand acres of good new land, at any fixed or given

price, (for example fifteen shillings, sterling per acre *) and if he should be able by force of money, in one year to clear all the meadow land and half the plough land, by making pot ashes or pearl ashes, in the second mode above mentioned, he would immediately raise his property in productiveness to the level of the good cleared lands of Pennsylvania, New-York, &c. that is to seven, eight, ten, twenty, thirty and forty dollars per acre, for such are the prices, according to the quality, advantages of land and water carriages. and proximity to towns and villages. The capital or money employed to make the pot or pearl ashes would be replaced by the sales of them as above mentioned. This operation, when considered upon a scale of 100,000 acres, appears like a new creation of property.

The United States have been brought, by slow degrees to their present knowledge of the value of their wood and timber. It is said to be not more than twenty-five years, since the southern live oak or ever-green oak has been used in shipbuilding. The importance of pot-ash is by no means duly understood at this time, in several of the best wooded of these states. The value of the maple sugar tree is not yet universally known. It is said, that the Hemlock is capable of being made into shingles fit for home consumption or exportation, in a degree which is not understood; and the white pine is more valuable, than is supposed, for the same purpose. The southern pitch-pine, and even the yellow pine has been supposed, of late years to be more suitable than white oak for beams, carlines, sills, and other straight timbers for ships and houses, in places liable to rapid decay. It is little known, that it is as easy in America to procure a beam, for a ship of war, of white oak or pitch pine, in one entire piece, as it is difficult, in Great-Britain. The actual and progressive scarcity of all the most valuable kinds of timber in Europe has been hitherto noticed in as small a degree, as the diversified and unequal resources of the United States in that particular. The demand for wood and timber throughout the world has been greatly extended in the present century, by the increase of the aggregate tonnage of the fleets of public and private ships, by manufactures in wood, and by means of fire, and by the wonderful increase in the number and extent of commercial and manufacturing towns of Europe and America. The tonnage of the British navy for example in 1694, bears no comparison to that of 1791, and their private ships have undergone a similar augmentation. A defalcation of timber is perceived in most countries, and, in the manner of what has been said concerning grain, it may be safely affirmed, that *the unavoidable deficiencies of European wood and timber can only be supplied from America.* We shall therefore rapidly arrive at the use of our new lands, through the consumption of our forests by the countries and colonies of the old world; and the proceeds of our wood and timber in the mean time will be in lieu of the sales of grain and cattle.

The political importance of these great natural productions (wood and timber) is manifest and striking, in this age of manufacturing, and mercantile competition, and of naval rival-ship and ambition. The value of our forests to the seekers of the carrying trade and of naval power is greatly increased by their yielding their possessors prodigious quantities of tar, turpentine and pitch. It would be unwise however, in the United States to neglect *the due preservation of their timber:* and considering how obviously important it is, that we maintain an abundant stock, it is a comfortable reflection, that the present redundance and cheapness of American lands enables us to effect *the preservation and reproduction of our forests* with less inconvenience and expence, than any other civilized nation.

V

MANAGEMENT OF THE NEW SETTLEMENTS

La Rochefoucauld Liancourt. *Travels through the United States of North America . . .* I: 163–165. London, 1799.

I shall add a word or two on the methods practised by them in the management of these new settlements. When a family have come to a resolution to settle in this country, the husband, the latter end of summer, repairs to the spot where the settlement is to be made. The first thing he does is to cut down the small trees on one or two acres; he next barks the larger trees, and then sows a little rye or wheat. Of the wood he has felled, he constructs a small house, and makes suitable fences around it; a labour, which may be performed in about a month's time. He then returns to his former habitation; and, at the beginning of spring, he brings his family and the best of his cattle to the new settlement. His cows cost him little, being turned into the woods to graze: he then finishes his house, plants potatoes, sows

* This price is mentioned because it is a low medium of the *land-rents* of Europe, and because great quantities of fine lands, covered with woods, are yet to be purchased in America, at and under that price.

Indian corn, and thus is enabled to provide for the first year's maintenance. While thus employed, he is at the same time clearing more ground, burning the trees he has already felled, and, as far as may be, even those which he has barked. By this process the roots of the bushes are in a great measure destroyed; yet they require to be more carefully grubbed out of land, which is to be thoroughly cleared. The ashes afford a very useful manure, and, in the opinion of the best judges, are employed this way to much greater advantage, than when converted into potash, the making of which is, with the new settlers, merely the result of necessity; for if a saw-mill be at hand, the large trees can be conveyed thither by oxen. Thus, within the space of twelve months, a man may clear fifteen acres; and few families cultivate more than thirty. The barked trees are left standing for a longer or shorter time, according to circumstances, viz. the species of the tree, the nature of the soil, and the degree of the wetness of the season. The hemlock-fir will stand eight or nine years, the oak four or five, the maple three or four, and trees, all the branches of which have been burnt off, seldom fall before this time. The stumps of the felled trees, generally two or three feet high above the ground, hardly rot sooner than the barked trees, which have been left standing on the lands. The dwellings of new settlers are commonly at first set up in a very slight manner; they consist of huts, the roofs and walls of which are made of bark, and in which the husband, wife, and children pass the winter, wrapped up in blankets. They also frequently construct houses of trees laid upon each other; the interstices of which are either filled up with loam, or left open, according as there is more or less time to fill them up. In such buildings as have attained to some degree of perfection, there is a chimney of brick or clay; but very often there is only an aperture in the roof to let out the smoke, and the fire is made and replenished with the trunks of trees. At a little distance from the house stands a small oven, built sometimes of brick, but more frequently of clay, and a little farther off appears a small shed, like a sentry-box, which is the necessary, or privy.

Salt pork and beef are the usual food of the new settlers; their drink is water and whisky, yet there are few families unprovided with coffee and chocolate.

We should not omit to observe, that the axe, of which the Americans make use for felling trees, has a shorter handle than that of European woodcutters. Not only the Americans, but Irish and Geman workmen have assured me, that they can do more work with this short handled axe, than with the European. The blade likewise is not so large as that of the latter. Most of these axes are made in America, but considerable numbers are also imported from Germany.

Though some or most of the particulars above detailed may be found in works, which treat of the inland or back parts of America, yet I judge them not unworthy of a place in this journal.

Respecting the tenets or observances of religion, it should seem that little room is left for a due attention to either, among the inhabitants of Pennsylvania and other parts of Genesee. In the towns, as well as in all parts of the country that are in any degree populous, there are, indeed, every where places appropriated to religious worship; but, unless I am greatly mistaken, religion is generally considered rather as a political engine than a way to salvation. In the new settlements you meet frequently with religious books, but they contain the peculiar effusions of different sects, rather than the simple morality of scriptural religion. Prayer-books, with other devotional exercises of that description, are chiefly found among the rigid Methodists, or fanatic Scotch Presbyterians. Yet the bitterness and fanaticism of these sects are rapidly wearing away in these forests. Chiefly taken up with clearing the ground, and anticipating in imagination the beneficial results of their labour, they soon forget all other concerns.

VI

"ONE VAST FOREST"

F. C. VOLNEY. *A View of the soil and climate of the United States of America . . .* Translated with occasional remarks by C. B. Brown. Ch. II: 6–11. Philadelphia, 1803.

To a traveller from Europe, and especially to one accustomed, as I have been, to the naked plains of Egypt, Asia, and the coasts of the Mediterranean, the most striking feature of America is the rugged and dreary prospect of an almost universal forest. This forest is first discerned on the coast, but continues thickening and enlarging from thence to the heart of the country. During a long journey, which I made in 1796, from the mouth of Delaware, through Pennsylvania, Maryland, Virginia, and Kentucky, to the Wabash, and thence northward, across the Northwest territory, to Detroit, through Lake Erie to Niagara and Albany; and, in the following year,

from Boston to Richmond, in Virginia, I scarcely passed, for three miles together, through a track of unwooded or cleared land.

I always found the roads, or rather the paths, bordered and obscured by copse or forest, whose silence, uniformity, and stillness was wearisome. The ground beneath was sterile and rough, or encumbered with the fallen and decaying trunks of ancient trees. Clouds of gnats, mosquitoes, and flies hovered beneath the shade, and continually infested my peace. Such is the real state of these Elysean fields, of which, in the bosom of the European cities, romancers entertain us with their charming dreams. On the sea coast there are, however, many open spaces, where the progress of cultivation and the vast consumption of fuel in the cities have occasioned. There are likewise considerable openings in the western regions especially between the Wabash and the Mississippi, on the banks of Lake Erie, and those of the St. Laurence, in Tenessee and Kentucky, where the nature of the soil, or, more frequently, the annual or ancient conflagrations of the Indians, have opened vast deserts, called savannahs by the Spaniards, and prairies by the Canadians. These bear no resemblance to the arid plains of Arabia and Syria, but remind us rather of the steps or grassy wastes of Tartary and Russia. The prairies may be described as *steps,* covered with ligneous plants, growing very thick, and to the height of three or four feet. They display, in spring and autumn, a lively carpet of verdure and flowers, and such a scene is very rarely to be met with in the dry or stony plains of Arabia. In the rest of the country, especially among the inland mountains, trees are found in such numbers, and their prevalence is so little checked and circumscribed, that the United States, compared with such a country as France, may justly be denominated one vast forest.

If we submit this immense wilderness to a single comprehensive view, we shall be led to divide it into three regions or districts, each of which is distinguished from the rest by the nature of the timber it produces. The kind of tree, as the American observes, indicates the nature of the soil it grows upon.

The first of these districts I shall call the *southern forest.* It embraces the maritime parts of Virginia, the two Carolinas, Georgia, and Florida, and may be generally described as extending from the bay of Chesapeake to the river St. Mary, over a gravelly and sandy soil, spreading from a hundred to a hundred and fifty miles wide. All this space is thickly planted with the pine, fir, larch, cedar, cypress, and other resinous trees. It presents a scene of perpetual verdure, which, however, is only a cover for sterility, except in those spots which the course of rivers and alluvial depositions have fertilized, and which cultivation has made abundantly productive.

The *middle forest* comprehends the hilly parts of Carolina and Virginia, all Pennsylvania, the southern part of New York, all Kentucky, and the country north of the Ohio, as far as the Wabash. This whole extent is covered with the oak, ash, maple, hiccory, sycamore, acacia, mulberry, plum, birch, sassafras, and poplar. In the western part are found the cherry, horse chestnut, the sumac, &c. and all the kinds that indicate a rich soil, the only basis of the prosperity of this portion of the states. The resinous trees are mingled, in the plains and vallies, with those just mentioned, and form entire woods upon the mountains. They are met with in the chain called, in Virginia, the *south-west,* but, contrary to usual appearances, they here cover a red, deep, and fat soil.

The third district, or the *northern forest,* is likewise composed of the fir, pine, larch, cedar, and cypress. It spreads itself over the western parts of New York, and the inland countries of New England; exclusive, however, of the *inter-vales* and banks of rivers. It advances northward into Canada, and is lost at last among the deserts of the polar circle, where the trees dwindle down into thinly scattered junipers and other hardy plants, of stinted growth and scanty product.

Such is the general aspect of the territory of these states. The picture is composed of an almost universal forest, varied and broken by five vast lakes, or inland seas, in the north; by immense natural meadows, or prairies, in the west; and in the centre by a chain of mountains, whose ridges are parallel to the sea coast, at the distance of from fifty to a hundred and fifty miles, and which turn, to the east and west, rivers of a longer course, wider channel, and more ample stream than we are accustomed to meet with in Europe.*

*M. Volney probably limits this comparison, in his own mind, to France or Britain, for the German, Polish, and Russian rivers fall not short of ours, in any of these circumstances. The American reader may listen with less dissatisfaction to our author's idea of an universal forest, when he is reminded that our present population consumes and exports the product of less than *one fiftieth* of the whole surface, and *fifty* acres of woodland would hardly be lessened to the eye, by cutting down *one* acre only. This diminution would be still less apparent, if the acre of wood thus removed were not an entire acre, but made up of trees scattered irregularly through the

These rivers are broken into cataracts, from twenty to one hundred and forty feet in height, and enter the sea in mouths that expand into gulphs. In the southern regions, the bogs or swamps extend above three hundred miles. In the north, the snow lies on the ground four or five months in the year. On one side, in a course of nine hundred miles, are scattered ten or twelve towns, built entirely of brick, or of painted wood, and containing from ten to sixty thousand souls. Without the cities are scattered farm-houses, built of unhewn logs, surrounded with a few small fields of wheat, tobacco, or maize, that are still encumbered with the half burnt stocks of trees, and are divided by branches laid across each other, by way of fence.* These rude dwellings and fields are embosomed in the depth of the forest, and diminish in number and extent, as you advance inland, till they appear, from neighbouring heights, like little squares of brown or yellow, on an immeasurable ground of deep green. The atmosphere is, by turns, very dry or very moist, very hot or very cold, very turbulent or very still; so capricious, that the same day will freeze with the colds of Norway, scorch with the ardours of Africa, and present to you, in swift succession, all the four seasons of the year. This is a concise but faithful picture of the United States.

VII

"DIFFERENT IMPRESSIONS PRODUCED ON AN ENGLISHMAN AND AN AMERICAN BY THE SIGHT OF WOODLAND SCENERY"

ADAM HODGSON. *Letters from North America, written during a tour in the United States and Canada* I: 296–298. London, 1824.

I was delighted with Vermont, which well deserves its name; and I do not think I have had a more interesting ride, of the same length, since my arrival, except, perhaps, in the Valley of the Shenandoah. Wood crowned mountains, with deep rocky defiles, secluded vallies, into which cultivation has yet scarcely penetrated, luxuriant meadows, and beautiful streams are thrown into fresh combinations at every step; and while the variety of the landscape delights the eye, its extent is seldom sufficient to fatigue it. As I rode along, I found it difficult to believe that I was in one of the old States, everything wore such an air of youth and freshness. Even from those earlier settlements, which recall to memory events of deep historic interest, the eye wanders to mountains and forests, where nature is still arrayed in her primeval dress.—I think I never alluded to the different impression which wood, as a feature in a landscape, conveys to an Englishman and an American. It is a striking proof of the power of association. In the eye of an Englishman, (to whom the sight of wood usually suggests ideas of shade or shelter, of rural beauty, or of such sylvan solitudes only as are sedulously preserved to afford protection to game;—to add variety to park-scenery, or to contrast with rich cultivation, in their immediate vicinity,) the trees which generally cover the American mountains, even to their summits, detract somewhat from their sublimity. In the imagination of an American, on the contrary, they invest them with whatever of dreary desolation, desert magnificence, and savage nature he has learned from infancy to associate with his interminable forests, and with the wild beasts, and wilder Indians, which inhabit them.

With him woodland scenery, even of a milder character, partakes of the wild or the sublime; and if mere cultivation be not beauty, it is closely allied to it in his imagination; and from its intimate connection with utility, which enters largely into his idea of beauty, it awakens many kindred associations.

Every acre, reclaimed from the wilderness, is a conquest "of civilized man over uncivilized nature"; an addition to those resources, which are to enable his country to stretch her moral empire to her geographical limits, and to diffuse over a vast continent the physical enjoyments, the social advantages, the political privileges, and the religious institutions, the extension of which is identified with all his visions of her future greatness.

VIII

BENJAMIN VAUGHAN AND THE VIEWS OF A NEWCOMER

Benjamin Vaughan left Europe in 1796 and settled on the family estate he had inherited from

whole mass; but this has been pretty much the case in the settlement of North America. By an eye that could view the whole territory at a single glance, nothing would be seen but a *boundless contiguity of shade*. Very different, however, would be the face of things partially seen.—TRANSLATOR.

*Those who are not enabled, by their own observation and experience, to qualify this general representation, will be led by it into great errors. In traversing New England, Jersey, and the eastern parts of Pennsylvania and Virginia, the scene is widely different from that above described. This picture is fully realized in those quarters only which are newly settled, and where attempts have just been commenced for reclaiming the wilderness.—TRANSLATOR.

his mother at Hallowell, in the District of Maine. There he devoted his life to philosophical, scientific and agricultural pursuits and undertook the systematic development of his ancestral acres, while writing articles in English and American periodicals and newspapers, under various pseudonyms, and keeping up a very extensive correspondence with many friends and his brother John who was living in Philadelphia. Some of his views on agriculture will be found in his edition of *The Rural Socrates*, originally written in German by Hans Kaspar Hirzel, and translated and printed at Hallowell in 1800. Two manuscript documents, dealing with forestry and recently found in his papers, have been obtained through the kindness of one of his descendants, Mrs. Mary Vaughan Marvin, who graciously gave permission to the Society to reproduce them in this appendix. The first one contains a more detailed description of lumbering operations, as conducted in Maine at the time, than I have been able to find anywhere else. Being a newcomer and the owner of extensive tracts of forest land, Vaughan was particularly interested in the method followed by the wood cutters of his district. His conclusion on the methods developed and results achieved by the "native Americans" deserves special attention. It would seem from the style of the "paper" and from the appearance of the manuscript that it was intended for publication in an English periodical. I have been unable to find out whether it was ever printed. The second document, which is a contract, indicates the system followed by Vaughan in clearing forest land for agricultural purposes and the modifications he had introduced in the local procedure of the wood cutters.

A

An account of the method of *preparing wood-lands for cultivation*, used in the vicinity of the river *Kennebeck*, in the district of Maine, from latitude 44 to latitude 45 north.

Wood is too abundant & labor too scarce in a new country, to admit of other than coarse operations for clearing lands from the woods with which the early hand of nature has almost constantly clothed them. Two methods have been employed for removing the woods in the neighborhood of the Kennebeck; the one, that of *cutting & burning them;* the other that of *girdling the trees;* for trees are never taken away by the *roots* unless required for the placing of houses, or orchards, roads, or some such circumstance.

The method of *girdling* a tree (that is, destroying a tree gradually, by taking from it a large ring or circle of its bark,) is rarely practiced here. When a tree perishes by this means the parts which from time to time fall from it, endanger both man & beast, obstruct the scythe, & require repeated clearings of the grounds, which are sufficient objections to the practice.

It only remains then to speak of *cutting and burning* the woods. This is commonly done in June, when the leaves have appeared & the tendency to sprout in the trees which have been felled & in the roots which still remain in the ground has abated. If this is deferred till July the trees will be in less forwardness for burning, & the sowing of the corn in the ensuing spring will be interfered with.

It is a great object to have the trees fall evenly together, according to their leaning or hanging; which is generally understood here to be from West to East. This parallel position in the fallen trees facilitates the moving of them, as well as aids the subsequent operation of the fire.

Nor is it less serviceable to attend to it in the case of a *drive*; a name given to the impulse derived from the fall of one or more great trees, acting upon other trees cut through about one third in a given direction & standing before the greater trees. A great tree when felled, sets those in a line before it in motion, as these do others in succession; the whole resembling cards placed upright in a line behind each other, of which when the first is thrown down, the rest fall in order. The line of trees thus prepared to be struck down, is about 2 or 3 rods wide, & 40 or 50 rods long.—By this method half an acre of trees sometimes falls at once, but a quarter of an acre frequently. It demands judgment however to give full effect to this manœuvre; & the incision in the trees to be thrown down must be proportioned to the circumstances of the case.

The ready falling of a tree depends upon its leaning, its size, & its weakness whether arising from its species or its unsoundness.

Trees are felled by means of two incisions, directly opposed to each other; of which the largest & deepest is commonly on the side toward which it is proposed that the tree should fall. But accident or convenience sometimes leads to a reverse in the depths of these incisions. The intent of the incision on the falling side is not only that the tree may easily bend, but that it may be properly guided. In short, the tree better takes the angular position to be assumed in its fall, when the substance of wood lying in the way of the proposed angle is removed.

The axe is applied to any part of the tree within reach, where the diameter is least, provided some objection does not present itself.

A tall man, with long arms has here an advantage. There are said to be those who will cut ⅔ of an acre, or even an acre of heavy growth of trees in a day; but ⅓ of an acre is called steady work.—It is always to be understood, that the forests here have little underwood, unless in low lands.

The metal of the *axe* used for cutting standing trees is by no means wide or long. It is divided into the edge, the bit, the eye & the head (commonly called here the pole.) The *bit* is the part lying between the *edge* of the axe, & its *eye* where the handle is inserted. The *head* (or pole) is the blunt part of the axe lying on the other side of the eye.—The weight of metal is to a certain degree shaved on each side of the handle, & is in particular kept away from the edge & the parts near it. As the lower side of the incision is horizontal, this arrangement permits the axe-man to hold his axe horizontally with little effort, when striking his horizontal blow. This does not impede the blow which goes to form the upper part of the incision, which is struck in an angle of about 45°; the equipoise of the axe being thus easily maintained in all its directions.—The handle of the axe used in felling is commonly about 32 inches long; the length of the metal is about eight inches, & its breadth near the edge four inches; and the whole weight of the axe about five pounds. The edge of the axe is fine, but not sharp; being ground against the direction of the motion of the grind -stone. If it were made fine, it would the more easily break in cutting frozen wood in the winter.—When the tree is felled, other axes may be used to advantage in cutting off the branches, or in dividing the trunk. On the other hand, the broad axe is the axe used in dressing the sides of a trunk reserved for timber. A particular axe, called the mortise -axe, is used for piercing mortises in posts where the land which is cleared is to be fenced with rails.

In *the position of the trees which are felled & to be burned,* three objects are consulted; first their lying close to the ground, next their lying parallel to each other, and lastly their easy rolling.

Some cut up the trunks & tops, as the trees are felled: others do this later, but before the fire is put in. The more common practice is, to cut only so much of the trunks & tops as lie across others, & thence present a near approach to the ground.

The *season for burning,* if corn is to be planted (by corn always meaning Indian corn or maize) is as early as may be in the following spring. To anticipate this time may occasion what is called a bad burn, & thence a small crop. Commonly the period of burning is between the 15 & 25 of May, but sometimes not till a fortnight later. In the year 1797, most of the corn (that is Indian corn) on burnt land was sown after June 5, & yet the crop was seldom better. Some have burned in the September of the same year, if the trees were felled early; and some have even afterwards sown European grain; but the sowing of such grain in this case is not frequent.

The *mode of burning* is nearly uniform. The operation takes place in the middle of a clear day with a dry wind, which in an American climate generally implies that the wind is then Westerly. If the season is too dry, the land is injured; & the fire extends farther than is desired. The fire is always commenced to windward, & is generally communicated by the flaming bark of white birch (placed in the slit of a stick) which is passed among the dry leaves & other vegetable matter upon the ground. To give the fire its full strength, the windward side is inflamed in various places nearly at the same time. The fire commonly stops of itself, penetrating only about one rod into the standing woods, though not without scorching them.—If from the dryness of the season, there should be danger of the fire extending itself much beyond the fallen wood, the communication is cut off by prudent persons. Sometimes, the dry matter on the ground is scraped up at the distance of some feet to the leeward of the fallen trees, sometimes, after the fire is well kindled to windward, other fire is put to leeward to destroy this dry matter at the moment that the windward fire is drawing to itself the leeward air, thus removing this matter from the action of the principal fire to windward; and sometimes both these precautions are taken at once.* The efforts of what is called a *good burn,* are to leave nothing remaining but the main trunks of trees. Where the burn is defective, the remaining branches are cut, heaped, & burned; before any thing is put into the ground.

After the first crop has been taken off, *a new attempt is commonly made to free the soil from wood;* which is effected by cutting the remaining wood into lengths from 12 to 20 feet, piling it into heaps containing each from one to three cords, and firing it on a dry day. While this second fire is acting, some attendance should be given, to keep the wood heaped together by means of handspikes; and sometimes to throw the remains of two or three heaps into one.—In any event, it is useful to pile together such wood as remains from the first burning. Cattle are usually employed to draw together the distant logs in these operations.

If the *fire is neglected to be applied* to the fallen timber in the first instance, the suckers from the roots or stumps, and the bushes from a great variety of seeds before unobserved in the soil (as the shumack, fern, English raspberry &c.) spring up, & render the process of burning & clearing much more

*Note. This may seem a needless care to many in Europe, ignorant of the drying nature of some of the American winds, and unapprized of the great spring and summer-heats in the lower parts of the District of Maine. But an extensive conflagration in New Hampshire in 1780, sufficed to produce a smoke which made candles necessary at noon day, extended for 200 miles, & was seen at a distance at sea. In the township of Hallowell, a trivial accident, two or three years since, inflamed a part of the woods & was near burning some houses situated at a considerable distance, forming part of the settlement or town.

expensive. A short and weighty scythe called a *stump-scythe*, of which there are several species each carrying with it a heavy stroke, must now be employed; and the axe is used to hew down whatever the scythe does not cut off. The fire is then passed through, & next the plough; after which potatoes should succeed, the digging of which usually compleats the operation.

The treatment of burned land somewhat varies. The most approved mode of sowing it with corn (that is Indian corn) is what is called here *inoculation*; which is lifting up with the corner of the hoe, two or three inches square of the surface of the ground from ½ to 1 inch thick; and putting in 4 or 5 Indian corns. The surface is then restored as before, by treading upon it. Some however place earth upon it.

Some good judges advise, as a general practice, the sowing European winter- grain & grass, in preference to Indian corn; and the grain they recommend is either wheat or rye; grass always accompanying it.

If Indian corn is used, the grain & grass always follow this corn.

The grain & grass-seed are harrowed in among the stumps with an angular harrow (called a crotch-harrow) of which each of the two pieces or limbs is about 6 feet long; having an iron-tooth in it at the distance of every foot; so that the teeth are about 13 in number, including that in the angle. Round the large stumps or rocks, or other impediments, where this harrow misses its stroke, the hoe is used.

Brakes & bushes among the Indian corn may be cut down, & the weeds may be thrust down; but it is not customary to break up the surface of the ground during the crop, even to make hills for this corn.

This corn may be sown in a day or two after the burning has taken place, if other things are favorable; but if a fall of rain intervenes, it is considered as an advantage.

Of the wood, nothing is saved, if fire is the method used for clearing the land; which, extravagant as it may seem, cannot in this case be avoided. If it is wished to save any timber, it must be previously withdrawn; but standing trees can in no shape be protected among the flames.—Nor is this considered as much loss as to the standing trees; for many of these die, if left bare, after having made part of a wood. Their shallow roots often render them a prey to the wind, & perhaps to droughts; & the want of lateral branches, arising from their having stood close to other trees, seems another disadvantage.—This frequent want of success as to single trees, has led to the expedient of preserving valuable timber, by suffering select pieces of the original woods to remain entire; which may happen to farther convenience of furnishing shelter to a house, farmyard, or orchard.

The ashes where large piles of wood have been burned, are in general dispersed, as nothing grows on the ash-heaps; and this fertilizes the land. These ashes are commonly too dirty to sell readily to the makers of pot-ash, who find them apt to foul their kettles, which are of cast-iron.

The bark however of certain trees, if the trees are felled in June, is stripped before the fire is permitted to pass; as of the hemlock* and the oak, which are both used for tanning. Of late, the bark of birch and of beach is preserved by some. In all cases the bark is taken in the spring or a little later.

It is now proper to notice some *incidental circumstances*.—Before a tree falls by the axe, it gives a crack or noise; & the axe-man looking upwards sees what is to be the course of its fall, which must be in one of two directions from the manner of cutting. He easily saves himself; especially as the tree commonly shoots some feet forward from the stump; owing to the incision or knotch made on the falling side, which prevents any splinter from checking this tendency.

Accidents however arise from other causes. If the tree in its fall lodges upon others, the axe-man sometimes suffers by its sudden motions, in his attempt to bring it to the ground.—If he is unexperienced, he may be injured even in separating from its roots the trunk of a tree overthrown by the wind. The roots in this case, owing to the connected weight of earth, often suddenly resume their places; & if the axe-man stands on that side of his cut which is nearest to the roots, he may be thrown to a great distance. He should therefore take his station on the main trunk.

If it is wished, for forming a mast or other purpose, to save a tree from breaking in its fall; it is usual, if no standing trees offer, to place some fallen trees in its way, upon which it may lodge. Sometimes a crosspiece is put, on which the falling tree may strike about the distance of one third from its lower end; the stroke being thus as is well known made as even and smooth as possible.

The mast or white pine, which is one of the noblest productions of the district of Maine, is nowhere found of greater size than on the Kennebeck; which sent a spare mast for the frigate, lately built at Bos-

*Note. There is a species of pine called here *the hemlock* without any addition. This hemlock is found in prodigious abundance; & looks somewhat like the cypress or even the cedar, known in the English-shrubberies, when it is young. When it grows old it loses all its beauty, its side-branches perishing, & a heavy moss being apt to cling to it. It's bark is not only used in tanning, imparting to leather a red hue; but to create a quick & bright flame as fuel. When the timber is employed green in water it resists the action of water far better than any other timber of its species & perhaps better than most timber known to us. The timber even when in itself straight, has commonly more or less of a twist in its [*illegible*].

ton, of which the diameter at ⅛ of its length from the larger end was 32 inches, its whole length being 96 feet. The largest masts cut on this river possess a diameter of 36 inches at ⅛ of their length from their larger end, this part of them being called *the partners;* and as their whole length must be in the proportion of one yard for every inch of diameter possessed at *this section of the mast*, the whole length of such masts is 108 feet. The diameter is always measured after the mast is dressed, that is pared from its bark, sap, & irregularities; the tapering of the mast happily nearly corresponding with the original tapering of the tree.—The British navy was formerly largely supplied with masts from this river, & the means of continuing the supply for some time still remain.—One of the varieties of the white pine often divided its trunk into two & sometimes more straight stems. From the peculiar height of the white pine where it happens to be alone, it may often be made a land-mark through a large tract of country.

In the *final clearing* of the land, while other stumps decay, & are easily pushed or pulled away in the course of 6 or 8 years; that of the white pine stands its ground with peculiar stubbornness. It is even said, that *no man ever cut down a large pine and lived to see the stump rotted.* It would be easy however, were it worth the trouble in the opinion of the Kennebeckers, to remove the roots of this pine along with its trunk; as the roots of this pine when found in the woods, are, like the roots of most of the trees found in the woods in this neighborhood, very superficial, & the length of the trunk forms a great lever for tearing them from their bed.

The *whole expence* of felling & clearing an acre of land, fit for the harrow is generally from 10 to 14 days work; and the crop is from 20 to 30′ fold, a bushel being generally sown @ acre. The expence in moist low lands is much more considerable; & hence & from the rank growth of their first crops, these lands, which in Europe, form some of the most valuable soils & which might easily be tamed by being applied to the raising of hemp & other exhausting crops, are here little valued; hilly lands, even when encumbered with rocks, being always preferred. But it must be observed, that it is only since the peace of 1763, that settlers have spread themselves in this vicinity, & that among these there are few foreigners; the whole number or most having been furnished by the Eastern (that is the Northern parts of the District).

Such are the leading remarks to be made respecting the method of clearing land from its original woods, employed on the Kennebeck; remarks, revised & indeed in many respects suggested by General Dearborn, Col. Howard, & other judicious & experienced observers. *A foreigner may judge the system improvident;* but were he transported to the scene of it, he would in a short time cease to wonder. The Kennebecker is obliged to have land for cultivation; and, though he would be pleased to turn his timber to account, yet where no purchaser of it offers, this consideration cannot stop him. Every thing in short depends upon circumstances; & as water notwithstanding its intrinsic value, is sometimes not only useless, but to be got rid of as a burthen; so it is with much of the standing timber in Kennebeck.—The fault then does not lie in the system of the Kennebecker, but in his manner of applying it. He would be justified in clearing some of his land in the manner described, but he clears *too much of it at a time;* & thence deprives himself of the possibility of profiting by a change of circumstances. Did he clear less land, & use the practice of manuring, with other agricultural aids; his timber left on the residue would soon become important even to himself, for fuel, fences, & buildings, & often would it serve him as an object of sale. By waiting five or ten years only, there are situations where the timber would furnish more than the means of paying for the land on which nature has placed it; & to a man's descendants the benefit might be very considerable. These however, are not principles easily relished by Americans notwithstanding for instance the expence of fuel to many American families living in or near certain great towns, has already become greater than in many countries of Europe. Unfortunately the productiveness of small quantities of land under high cultivation is wholly unknown in most parts of America; & the desire of possessing large farms, though badly cultivated is founded under such circumstances in certain feelings of the human mind, which the American farmer cannot readily subdue. The best experienced Kennebeck farmers are also persuaded, that they can raise Indian corn and rye at less expence @ bushel from good hardwood* land newly cleared, than from any grass land in the country, even allowing the grass land to be free of rent. It may be added that the Kennebeckers, like other Americans, have little of that predilection for trees and woods as objects of beauty, which prevails in old countries. But time will insensibly produce changes in these respects; & in the interim, the astonishing destruction of woods along the Kennebeck may produce some beneficial alterations in the climate, in which each individual inhabitant shall share.

It must not be suspected from this observation,

*Note. Timber is divided here 1°. into the *black-wood or ever greens,* which look black amidst the snow and are almost universally of the pine or fir kind, not excepting what is here called the cedar, which is the *arbor vitae* of the English shrubberies. 2°. into the hardwood, which is understood here to embrace every other kind of timber, excepting 3°. the oak, which is of several kinds & is held to form a species by itself.

that the climate of Kennebeck is such as some have painted it; who judge its summers to be cold in proportion to its winters. Its winters, though cold, are dry, clear, supereminently healthy, & only occasionally subject to the inconvenience attending thaws in a snowy country, and they form the principal season for gaiety & for conveying heavy commodities to market by land; whilst its summers are capable of producing melons & Indian corn in the open air, from the seed to the full ripening, by ordinary management. But it is apparent from experience, as well as reason, that a country abounding in woods, especially where a large proportion of these are evergreens, cannot so early in the year get rid of its snows, as when it shall have become what is here called *cleared* (that is, cleared of its surplus proportion of woods;) & this part of the District of Maine wants nothing to make it answer every expedition of its settlers, but a *more early spring*.

There are few countries where the method of clearing land from its aboriginal woods which is above detailed, will be applicable. If useful, for example, in Russia which is in part to be considered as a new country, it is probable that it is known there already, or else something which is equivalent to it. In countries like New Holland, the statement may be more in point. But in order to introduce it in perfection, there or elsewhere, the presence of a few native Americans used to new settlements, with their tools, should be obtained; & from such persons, not only their art of felling and burning woods, but that of dressing & drawing timber, & of shaping various kinds of lumber, & like wise of moving large stones may be learned with advantage; as they do much, in the rough manner which the case calls for, with few tools and a simple apparatus.

Finis

Hallowell, January 24, 1798.

B

A Contract with a Wood Cutter

We the undersigned consent to receive permission from Mr. Benj. Vaughan of Hallowell, to cut & carry off wood from the farm-lot lately belonging to Mr. Freeman Hinkley, on the great lot 22 in Hallowell, on the following conditions: 1. To keep two rods within the lines so as to avoid marked trees & scorching the standing wood beyond, & to leave logs for fencing: 2. to leave all oak & ash fit for timber & lumber, all pines fit for masts, & all maple fit for vessel-keels; 3. *to cut down* all the hard wood not here excepted, just as it offers, *whatever be the state of it;* but not to be requested, unless for their own objects, to meddle with any black wood; 4. *to take off* the fallen hard wood, which is sound, & easy to be got at; 5. to throw the brush & other offals from the wood on or near the bare roots or the stump of a fallen tree, when it can be done with convenience; that the roots & stumps may afterwards be scorched in the burning, to prevent their sprouting; (agreeably to Mr. B. Vaughan's plan for clearing & burning the land;) but in any event the brush must not be thrown into the teaming tracks.

The above conditions are to hold till the ensuing spring (of 1800) nothing being demanded for the woods to be taken away.—Mr. B. V. further recommends the drawing off some of the wood to some safe place or places at hand, thence to be hauled away at leisure; independent of that to be drawn immediately into the settlement. By this means much may be hauled off during the time limited; for it is intended to fell & burn what remains on the lot, in the common manner in the spring; & afterwards to shut up lot 22, (as well as 23,) to all wood-cutters.

NATHANIEL P. GRIFFIN . His X. Mark.

Witness: WM. TUCKER.

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